m Library

NOV 19 1934

JOURNAL OF MAMMALOGY

Vol. 15 NOVEMBER, 1934 No. 4

AMERICAN SOCIETY OF MAMMALOGISTS

The American Society of Mammalogists

Founded April 3, 1919
Incorporated April 29, 1920

VERNON BAILEY, *President*
H. E. ANTHONY, T. S. PALMER, *Vice-Presidents*
ROBERT K. ENDERS, *Recording Secretary*
ROBERT T. HATT, *Corresponding Secretary*
MRS. VIOLA S. SNYDER, *Treasurer*
EDWARD A. PREBLE, *Chairman, Editorial Board*

Additional Directors

1933–1935	1934–1936
JOSEPH GRINNELL	W. K. GREGORY
REMINGTON KELLOGG	RUDOLPH M. ANDERSON
A. BRAZIER HOWELL	CHAS. C. ADAMS
W. E. SAUNDERS	H. H. T. JACKSON
HAROLD J. COOLIDGE, JR.	LEE R. DICE

C. HART MERRIAM
E. W. NELSON
WILFRED H. OSGOOD
GLOVER M. ALLEN
WITMER STONE
MARCUS W. LYON, JR.
} Past-Presidents

Trustees

H. E. ANTHONY (1931) W. K. GREGORY (1932) W. REID BLAIR (1933)

Standing Committees

Editorial: Edward A. Preble, *Chairman.* Glover M. Allen, Arthur H. Howell, Remington Kellogg, Gerrit S. Miller, Jr., Wm. L. Straus, Jr.

Life Histories and Ecology: George M. Wright, *Chairman.* E. A. Goldman. William J. Hamilton, Jr., C. E. Johnson, E. Raymond Hall, O. J. Murie, Robert T. Hatt.

Anatomy and Phylogeny: A. Brazier Howell, *Chairman.* W. K. Gregory, Carl Hartman, Adolph H. Schultz, George B. Wislocki.

Bibliography: Gerrit S. Miller, Jr., *Chairman.* Lee R. Dice, C. Lewis Gazin, Paul Moody, Arthur J. Poole, Arthur Svihla, William L. Straus, Jr.

Marine Mammals: T. S. Palmer, *Chairman.* Glover M. Allen, Remington Kellogg, Gerrit S. Miller, Jr.

Economic Mammalogy: Charles E. Johnson, *Chairman.* Joseph Dixon, Junius Henderson, S. G. Jewett, Adolph Murie, M. P. Skinner, G. M. Wright.

Conservation of Land Mammals: H. E. Anthony, *Chairman.* Lee R. Dice, Madison Grant, Joseph Grinnell, T. S. Palmer.

Nomenclature: Wilfred H. Osgood, *Chairman.* Glover M. Allen, Arthur H. Howell, Gerrit S. Miller, Jr., T. S. Palmer, George Gaylord Simpson.

Membership: Philip M. Blossom, *Chairman.* R. M. Anderson, Leo K. Couch, Joseph Dixon, Tappan Gregory, Lawrence M. Huey, W. P. Taylor, M. R. Thorpe.

The Journal of Mammalogy

Subscription rates, $4.00 per year; single numbers $1.00 each. Sent free to all members of the American Society of Mammalogists not in arrears for dues.

Subscriptions, changes of addresses, requests for missing numbers, applications for advertising rates, etc., should be sent to the corresponding secretary, Robert T. Hatt, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y.

Manuscripts for publication, books and papers for notice and reviews, etc., should be sent to Edward A. Preble, U. S. Biological Survey, Washington, D. C.

Entered as second-class matter, November 22, 1919, at the Postoffice, Baltimore, Md., under the Act of March 3, 1879.

Made in United States of America

JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists

VOL. 15 NOVEMBER, 1934 No. 4

THE ABILITY OF THE GIANT KANGAROO RAT AS A HARVESTER AND STORER OF SEEDS

BY WILLIAM T. SHAW

In the late winter and early spring of 1933, casual observations were being made upon the activities of the giant kangaroo rat, *Dipodomys ingens—Perodipus ingens* of Merriam. Certain findings revealed methods of garnering, curing, and storing food that at once excited our curiosity, so we were led to undertake a more extended inquiry, lasting throughout the spring and early summer and eventually into the following year. The field of investigation was at Panoche Creek near where it leaves the foothills of the Coast Range Mountains and enters the plains, about 50 miles west of the City of Fresno, in Fresno County, California.

The locality is in the Lower Sonoran Zone, at an elevation of about 550 feet. At the beginning of the investigation, February 10, it possessed the promise of a fair vegetation. Hills were showing green with filaree (*Erodium*), peppergrass (*Lepidium nitidum*), fiddle neck (*Amsinckia douglasiana*), and a brome grass (*Bromus rubens*). In the immediate broad stream bed bottom lands, the grounds were covered with a matted growth of bitter salt grass (*Distichlis spicata*), which did not seem to figure in the food system of *Dipodomys*, nor yet did it appear to be palatable to well fed sheep.[1] By June 3, before the oncoming summer, when it was last visited, the area presented a landscape of unusual barrenness. Over-grazing, wind action and drought, all had done their part to render the territory destitute of vegetation. Meantime the *Dipodomys* had shown a remarkable activity in securing for themselves the necessities of life and were apparently holding their own against what to us seemed great adversity.

We were not to be long in learning one of their characteristics, which answered the question as to how they were enabled to exist in the face of so great

[1] For the careful identification of the pertinent plant forms of this paper, the writer is indebted to Messrs. C. H. Quibell, Jack Springer, and Elroy Robinson, of Fresno State College.

odds. It was soon apparent that they were skillful gleaners and inveterate storers of seeds. Many small mammals when first trapped will shrink from their captor, trembling with terror. It is not so with this *Dipodomys*. A newly-captured one when dropped into a box containing food, such as rolled oats, almost at once will begin picking it up and storing it into its cheek-

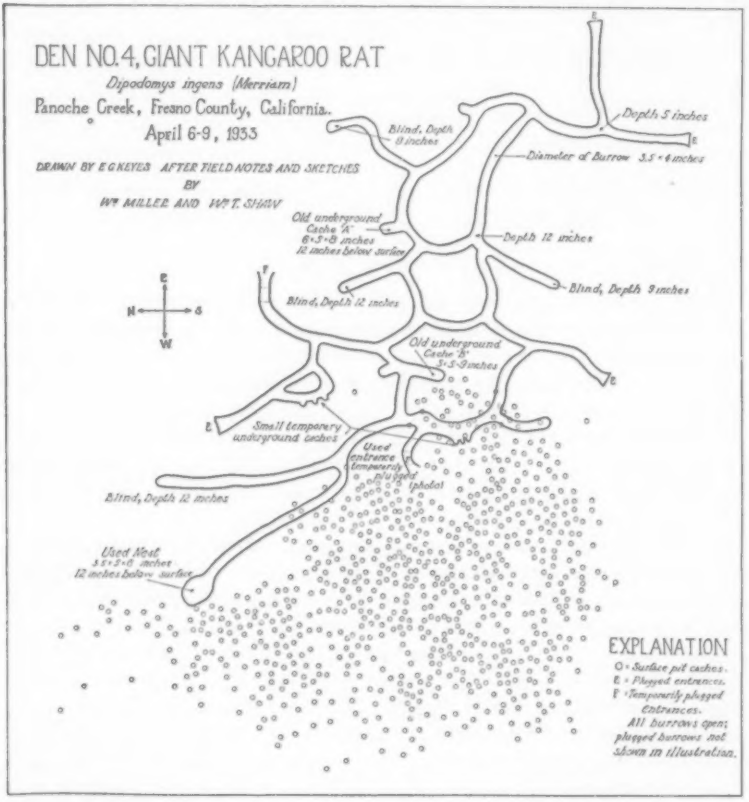

DEN NO. 4, GIANT KANGAROO RAT
Dipodomys ingens (Merriam)
Panoche Creek, Fresno County, California.
April 6-9, 1933
DRAWN BY E. G. KEYES AFTER FIELD NOTES AND SKETCHES BY W. P. MILLER AND W. T. SHAW
Depth 5 inches
Blind, Depth 9 inches
Diameter of Burrow 3.5 × 4 inches
Old underground Cache 'A' 6 × 5 × 3 inches 12 inches below surface
Depth 12 inches
Blind, Depth 9 inches
Blind, Depth 12 inches
Old underground Cache 'B' 3 × 5 × 3 inches
Small temporary underground caches
Used entrance temporarily plugged
Blind, Depth 12 inches
Used Nest 5 × 5 × 6 inches 12 inches below surface
EXPLANATION
G = Surface pit caches.
E = Plugged entrances.
F = Temporarily plugged Entrances.
All burrows open; plugged burrows not shown in illustration.

FIG. 1. SKETCH OF DEN NO. 4 OF *Dipodomys ingens*, SHOWING OPEN BURROWS AND POSITION OF SURFACE PIT CACHES IN RELATION TO THE DEN

pouches for future need. So all-absorbing is this desert-evolved desire to guard their patiently-gathered food that one was found deep down in a gassed den, dead, its cheek-pouches filled with seed pods of the pepper-grass which it had hastily picked up from one of its underground stores before being overcome by the fumes. Very shortly after their capture, they will take food from the hand, if no sudden motion is made to frighten them.

The winter rains had started vegetation by February 10 and 12, and the check-pouches of three trapped males contained young fresh leaves of pepper-grass. Another taken February 25 had its cheek-pouches filled tightly with green leaves of the pepper-grass, which at this time was about two inches tall and just coming into bloom. By March 21, this plant, at the same place, had nearly completed its fruiting. Evidently their harvest was on, for everywhere they were making use of the local vegetation. William Miller and Yancy Shouse, two biology students, out with flash lights at 9:00 P.M. on March 20 began running down and capturing them, cheek-pouches filled with seed-pods, which the living animals retained persistently until the pods were removed from them by the writer, using a process of reversion, not at all difficult. All of this activity was in anticipation of the surprise we were to find on the following day.

We had proposed to investigate their dens by digging. One had already been entered, but as the work was more or less exploratory, the effort was not completed. The excavating of den no. 2 on March 21 was to be more thoroughly done with the hope of accumulating carefully gathered data in regard to the underground life of the animal. We were cutting a vertical wall through the den from the surface to hardpan and were midway along when Miller noticed a little bunch of pepper-grass pods hidden on the surface of the ground beneath the dust. This was picked up and examined. It had evidently been placed there with intent of purpose. A little scratching away of the dry loose surface soil at the same spot soon revealed another and another of these deposits. They were uniform in diameter and depth, being roughly about one inch in diameter and one inch deep, *vertically* placed in the solid ground. In shape they suggested the closed end of a test tube of that diameter. Their contents could be easily pried out and lifted with an ordinary tea spoon. They were excavated in firm soil and filled nearly full of cached seed-pods which, while fairly well cured owing to the prevailing warm dry weather, retained some of their greenness of color like that of curing alfalfa. These little deposits were of quite uniform shape, their lower ends being convex, conforming to the bottom of the pit; the upper being concave, apparently tamped in by the rat with the nose after being deposited from the cheek-pouches. Apparently they were filled with the accumulation of the cheek-pouches after one trip to the harvest field. In captivity the animals seem to fill the two cheek-pouches simultaneously with a rapid motion of the front paws, while balanced firmly upon the hind feet. As the front feet are relatively small and as the mouth is held close to the ground, it is not easy to see the motion of the very rapidly moving paws and fingers. Continued search revealed these *surface-of-the-ground* caches to be very numerous; in one area twelve to the square foot were found, the total surface area of this den used for these caches being 17 square feet. The den itself covered a surface area of 17 by 21 feet. They are not widely scattered but closely placed, differing from those erratic empty pits occasionally observed over the surface of the desert, referred to by

both Bailey (1931) and Seton (1929, p. 426) and ascribed by them to a different use. Occasionally two adjacent pits are confluent, and once in a sandy soil a considerable deposit of seed-pods was found bunched in a scooped hollow on the surface and covered by dry earth. One of the surprising things about these deposits is that they are so well concealed, apparently with intent, their soil covering being protection against wind and possibly also against small rodent robbers of their own kind or others. Be this as it may, we had walked over these deposits for days without the slightest idea of their presence. Furthermore, they had been in the direct path of frequent large bands comprising several hundreds of sheep on their way to and from the back hills to the shearing sheds, their surfaces trampeled into dust, but without injury or disturbance to the caches.

That this was the work of one animal is probable, for as gas was used throughout these investigations it was possible in each case to take the owner or owners. In this instance an adult male weighing 150 grams was taken.

On the same and the following day den no. 3 was treated and excavated. From it were taken a breeding female and four half mature young females. Apparently they were mother and immediate offspring, as on dissection the mother showed four fetal-scars. It was evident they were working together, for again we not only found small surface-caches, but a much greater area than in den no. 2. Here we found a compact area of these caches covering 34 square feet, placed directly *upon* a den with a surface area of 17 by 22 feet.

It was now becoming evident that what we were finding was not accidental, so it was determined to make a more careful excavation of a den with especial reference to the surface caches. Accordingly on April 6 we went prepared to make an extended investigation, which lasted to the 9th. We were equipped with a means of measuring and charting, so that careful results would be secured and recorded. A rather typical den was selected, with a surface dimension of 10 by 12 feet. All of its entrances were plugged from the inside, one only temporarily so, and showed fresh signs of much use. That the occupant was at home was made evident by repeated drumming, a muffled sound apparently produced by beating the fur-padded hind feet upon the ground in the depth of the burrow. Indeed, in the summer when their granaries are full, the animals may be induced to reply to one's beating with the hand upon the ground above them, although they seem not to be so active with this response in the colder months. Surface examination showed great numbers of earth-covered caches. Such a cache-abounding area was photographed, showing the completely hidden condition of the stores, then the top soil was carefully removed and a picture taken of many of the caches as they appeared after being revealed and pried up slightly. It was later found that we had by no means uncovered all of the surface caches of this photographed area. For two days Miller worked painstakingly with this excavation and in the end had revealed all of the open, used burrows, although

there were many completely plugged channels that were disregarded. Finally the surface-caches were reached and their position upon the top of the den carefully located by means of our measuring equipment. The contents of each surface-cache was removed from its pit and carefully preserved in a small paper bag. The area of surface caches was 55 square feet. The sum total of these was 875. Subsequent patient laboratory examination by Audre Graff showed them to contain seeds of the following varieties, named in the order of their frequency of occurrence:

	Number of times found in caches
Lepidium nitidum, common pepper-grass	873
Oenothera, evening primrose	179
Erodium, filaree	169
Gnaphalium, cudweed	5
Plantago, plantain	4
Atriplex, saltbush	4
Bromus rubens, red brome	1

The common pepper-grass was almost constant in occurrence and in bulk far surpassed the other seeds found. Filaree was next in abundance. Evening primrose was found in a greater number of caches than the filaree, but in smaller quantities. This may have been due to the fact of its indefinite inflorescence and rather shy fruiting, permitting the ripening of only a few pods at a time. The great quantity of pepper-grass used is in keeping with the abundance of this plant, as shown by counts taken in this territory during the spring of 1934. Five counts showed the predominance of seedlings of the pepper-grass in four of them, the average of the five giving eleven pepper-grass plants to four of filaree.

The pepper-grass was stored most commonly in the form of seed pods and short terminal heads, while occasionally a cache was found to consist of almost pure shelled seed. Now and then entire pepper-grass plants were found in the surface caches, for in dry seasons like the winter 1933–34, when probably not more than one inch of rain fell during the entire season, those plants which had survived pasturing had matured while very tiny, one being observed March 24, 1934, only one inch tall, with 13 ripe pods and 21 seeds. In many places this was the average height. One would be led to believe that the hulls or pods of the pepper-grass as well as the seeds are consumed as food, for by the end of the winter season the underground stores are greatly reduced and turned to refuse. Filaree was also plentifully found, usually with the seed pods from which the beaks had been bitten. Occasionally a tiny plant was stored entire.

The abdomens of three ants were found in three different caches. Also two wings of a hymenopterous insect. Whether these were actually stored by the rats or whether they were accidental is not known. It is recalled, however, that on March 21, a living hymenopterous insect was taken from the cheek-pouches of a captive *Dipodomys* at the time of its taking.

The caches at the time of their opening were quite free of dust when pried up. They were frequently matted together as if they had been rained upon after being deposited, which was possible during the spring of 1933, when an unusual amount of rain had fallen. These matted caches were not scattered about but were grouped together in one locality.

Whether or not this was the work of only one animal is hard to say, but probably it was, as only one, an adult male weighing 154 grams, was taken.

It now seemed clearer than ever that these small surface-caches were not accidental. The fact that they were so uniformly placed and that they were in each case so intimately associated with a den, was convincing. Already we had been pondering its explanation and were formulating plans for further investigation. Similar work of the sun-curing of vegetation by the mountain beaver (*Aplodontia*) and the green twig mows of the cony (*Ochotona*) were suggestive. Should these greenly-gathered seed pods be taken at once to the depths of the dens, where at this season the soil was moist, they would soon become a total loss by moulding. Furthermore we had found no sign of this fresh material, with exception of a trace here and there along the sides of the under-ground burrows. True, we found large *under-ground* caches, but they were old, largely mixtures of fragments of hulls of previous seasons and fine sand. (Cf. Vorhies and Taylor, 1922.)

Careful thought on the matter suggested that this material might be left in this thoroughly dry situation, even protected from light rains that might possibly occur, by the covering of dust. Repeated days of warm to hot sunshine would do the curing. But what of the connection between these small *surface*-caches and the larger *underground* ones in the burrows of their dens?

Early in the investigation we had noticed that any surface-caches uncovered by us in the evening had their contents completely picked up by morning. On May 19 we determined to investigate this point more clearly. We selected three surface-cache-bearing dens and carefully uncovered the caches upon a square foot of each. In the morning we found that each had been visited as was manifested by abundant tracks in the sand over and about the exposed areas and by the little empty pits, now partially filled with sand accidentally brushed into them. Practically all the material we had uncovered the night before had been removed.

Still not satisfied with these observations, we returned once more on June 2 and 3. Clearly a change had now started in these areas of cached materials. Empty pits which we had noticed on our visit of May 19, were now plainly evident. The night being pleasant, with a fair moon and very little wind, we decided to make some first-hand observations. A typical den (surface pit no. 1) was selected and an area of surface-caches was uncovered. Some time after nine o'clock a comfortable spread of blankets was made about fifteen feet from the exposed caches. For a long time no sign of life appeared about the den and time passed without event; I must have spent much of the inter-

vening time in light sleep when I became aware of what sounded like a distant and repeated drumming. It seemed to resemble the far away *put-put* of an outboard motor boat, the *put-put* being quite rapid, which eventually aroused me sufficiently so that I snapped on the flash light. There by the exposed caches on the dusty surface of the den appeared the fairy-like form of a "Dipo." It seemed not alarmed by the sudden illumination, although the night was now becoming quite contrasty, the moon being about ready to dip behind the hills. Though not alarmed, still it went about timidly alert, for at no time during this extended observation did it cease its activity—its search for seeds we had so ruthlessly disturbed from its curing area. Its position now was quite characteristic as it moved alertly about, balancing on hind feet, with long tail extending straight backward, touching a point at three fourths of its length, with the portion beyond gradually curling upward. Its outline suggested a grounded airplane. The sudden flashing on and off of the light seemed not to disturb it, for the return of the light found it where it had been a moment before, and similarly occupied. Twice it left the den and came over to me. Presently it appeared before me within a few inches of the shining disk of the flash—big round black eyes, vibrating nose, vibrissae and all. For several moments it remained within arms length of my face. It had gone completely around me, a feat repeated once again that night, but only once, for no wide-range wanderings were entered upon.

Once during that night the quiet scene was disturbed. From out of the circle of light there appeared a small form of what might have been and probably was a deer mouse (*Peromyscus*). Immediately the scene became animated and the intruder was promptly driven into the outer darkness whence it came. The little scene was a fascinating action of silent, silvery, dancing, fairy forms. Quiet seemed to be the spell cast over the scene, for here were muffled, fur-padded feet, and soft nocturnal fur.

By and by the east began to glow and now Dipo's efforts at gleaning became more and more concentrated. Its night was closing in. Now it gleaned here and there rather indiscriminately. Timidity had left. The tail tip was no longer curled in anticipation of shock, but trailed as a drawn cord would have done, straight behind.

At first it found the surface caches we had uncovered and seemed to gather them in, then departed for the depths of its home, always entering by the same entrance with a whip of the tail. Once it took just one minute to fill its pouches, presumably from one of these surface caches. The interval underground was not long. On four occasions it remained 1 minute, ¾ of a minute, 1½ minutes, and 1 minute, 10 seconds, respectively. Its hops, in which it appeared to use the hind legs chiefly, were quick and low to the ground, like bounces of a nearly-spent soft rubber ball on a slightly uneven surface. The thought came to mind that this same method of locomotion might also be employed underground and would in a measure account for the unusually large diameter of the burrows in proportion to the size of the animals.

Slowly gray dawn came on and it was no longer necessary to use the flash. The animal's steadily-moving body now showed clearly as it gleaned earnestly over the dusty surface. Presently it hopped over to the door entrance, and now without action differing from that of the many other times it had entered there, it disappeared and did not return. This was at 4:24 A.M. At 4:29 the first linnet was heard and one minute later the voice of a raven broke the silence of dawn. Thus night gave way to day. At 4:45 I walked over and found the entrance to the vertical door closed from inside with a loose earthen plug.

From 1:00 A.M. the animal had been under rather constant observation. Between the hours of 1:00 and 2:30 it was under continued observation, during which interval it was busy all of the time, gleaning chiefly from the spot we had uncovered and going into the den. Now an hour elapsed without observation. At 3:30 it was still there and occupied.

This morning, June 3, we had determined to excavate the fifth den with the object of finding, if possible, whether or not the material of the small surface-caches was being transferred to larger underground-caches within the dens, as the observations of the early hours of this day had lead us to believe. Looking about we soon found a den, the surface of which was abundantly printed with foot- and tail-marks. Examination showed numbers of surface-pits completely empty, while others still retained their complement of seed pods. Muffled drummings from beneath told us the owner was at home. After the den had been gassed its excavation was undertaken with the usual care. The work being completed, it showed a surface area of 16 by 17 feet; area of surface-caches, 28 square feet, of which it was estimated that more than half of the caches had recently been emptied; two old underground-caches, indicated by remains of a few pepper-grass seed pods mixed with sand, and as we had expected, *two new caches*. The first was located six inches below the surface. It was circular, measuring $4\frac{1}{2}$ inches in diameter and contained fresh filaree seeds in the hulls. The second cache was a double one only two inches below the surface. Its dimensions were 5 inches wide by 15 inches long, with a vertical height of 7 inches, giving approximately a capacity of 525 cubic inches. It was approached by an open burrow from below and had two vertical openings through to the surface of the ground with diameters of 2 and $2\frac{1}{2}$ inches, respectively. These were filled with about an inch of soil and may have acted as ventilators. This cavity was completely and firmly packed with fresh material, the left side being of pepper-grass seed, and the right, filaree; in quantity amounting to $3\frac{3}{4}$ quarts. An adult male weighing 151 grams was taken from this den.

The work was now suspended for the summer and except for one or two casual above-ground examinations, which showed the absence of filled surface-caches, was not taken up again until December 8, 9, and 10, 1933, when den no. 6 of this series was excavated and charted with exceptional care by Melvin

Rudholm, under the writer's supervision. Its surface area was 16 by 22.5 feet. The area upon which old empty rather indistinct surface-cache pits existed was 66 square feet. Within the bounds of this area 305 pits were found. These were entirely empty and in some places appeared to be confluent, as if their walls had been destroyed or crumbled, or possibly they had been constructed that way, as suggested earlier in this article. Of underground-caches there were twelve, in what would seem fairly fresh condition. In addition there were twelve old caches containing large quantities of sand and traces of pepper-grass seed pods. The chief content of the newer caches was largely pepper-grass seed and seed pods, now containing quite a mixture of sand—noticeably more than was found in the fresh caches of June 3, 1933. These stores were rather uniformly near the surface, possibly for the sake of the sun's warmth and dryness. Of the twelve containing newer material, the shallowest was 3 inches below the surface of the ground, while the deepest was only 7.5 inches under. The average depth for the twelve was 5.5 inches. The shape tended to be oblong, with average dimensions of length, 10.2; width, 5.4; height, 3.9 inches. From this den a large male weighing 159 grams and a large female weighing 125 grams were taken.

The findings as recorded above, while illustrating behavior quite probable, were so new to us that we determined if possible to verify our observations by at least one additional season's investigation.

Accordingly, on December 17, 1933, a visit was made to Panoche Creek. The previous week had been stormy and probably provided the only rain during the months between May, 1933 and May, 1934. It was estimated by men residing in the locality that about one inch had fallen at this time. The ground was quite moist on the surface, but little signs of sprouting vegetation were visible.

The area was not visited again until January 25, 1934. Seedlings of pepper-grass and filaree were now in abundant evidence. Three surface-pit dens which had been staked June 3, 1933, were visited and it was found that these had been entirely effaced, probably by wind action and tramping of sheep, and now were wind-swept and hard, and sprinkled with fine angular flakes of whitish rock such as covered the general surface of the country hereabout. Very little sign of *Dipodomys* activity was noticed.

On March 16, 1934, the dens originally staked on June 3, 1933, showed signs of the expected activity, for now an area of about 9 square feet was pitted with small surface-cache pits, filled with seed-bearing pepper-grass pods of the 1934 crop. Examination of this den on March 24, 1934, showed a surprising amount of activity; for now an occupied area of about 78 square feet was found. Two other dens showed signs of similar activity. Vegetation from which these surface-pits were being filled was now well along.

On March 24, 1934, an attempt was started to determine whether or not the small surface caches are picked up later by Dipo and transferred to the under-

ground-caches. Accordingly pit-dens were treated as follows: an area of surface-pits, 2 by 2 feet, already made by Dipo, was marked off with small pegs driven firmly into the ground. Then the surface was examined carefully for pit-caches. When found, the contents of each pit were taken out and a little white rice and some of the pepper-grass pods from these surface-pits which had been dyed with mercurochrome and dried in the sun were placed in the pits, along with their original contents and covered over again completely with earth and dust. In this way it was hoped to establish the fact of transfer.

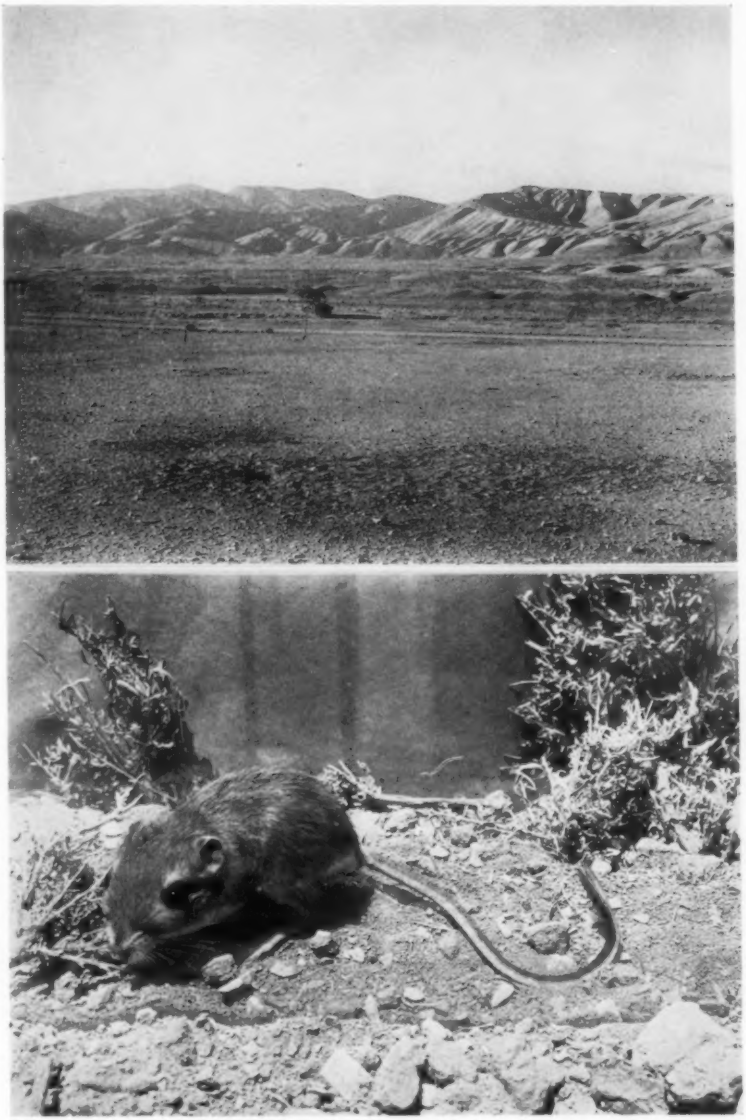
Four dens were treated thus on March 24, 1934. The number of surface-pits found in each 2 by 2 foot area was 33, 54, 64, and 55, respectively.

On April 21, 1934, the first and third small cache areas treated did not show signs of having any of their material carried away. The second one showed unmistakable signs of having had a part of its contents removed.

By May 4, 1934, there had surely been an extended effort to remove these surface-caches; two dens under careful observation showing 70 and 260 empty surface-pits, respectively, from which the material had been removed. The ground immediately bordering these still had seed-bearing pits.

Now we determined to investigate the fate of the mercurochrome-treated pepper-grass and rice-filled pits; accordingly on May 4, surface-pit den no. 4, the pits of which had been partly emptied on April 21, and from which not only all the pits in the small pegged rice-mercurochrome treated area, but all other surface-pits had now been emptied, was treated with gas and carefully excavated. Our findings were most conclusive and gratifying, for the den was supplied with nine new underground-caches, containing in amounts $2\frac{2}{3}$, $8\frac{1}{4}$, $1\frac{3}{4}$, 1, $4\frac{1}{2}$, $1\frac{1}{2}$, 2, $5\frac{1}{4}$, and 8 quarts, respectively, chiefly of pepper-grass and filaree, and *in four of these were found unmistakable deposits of rice and mercurochrome-treated pepper-grass seed pods.* From this den a large male *Dipodomys ingens* weighing 149 grams was taken.

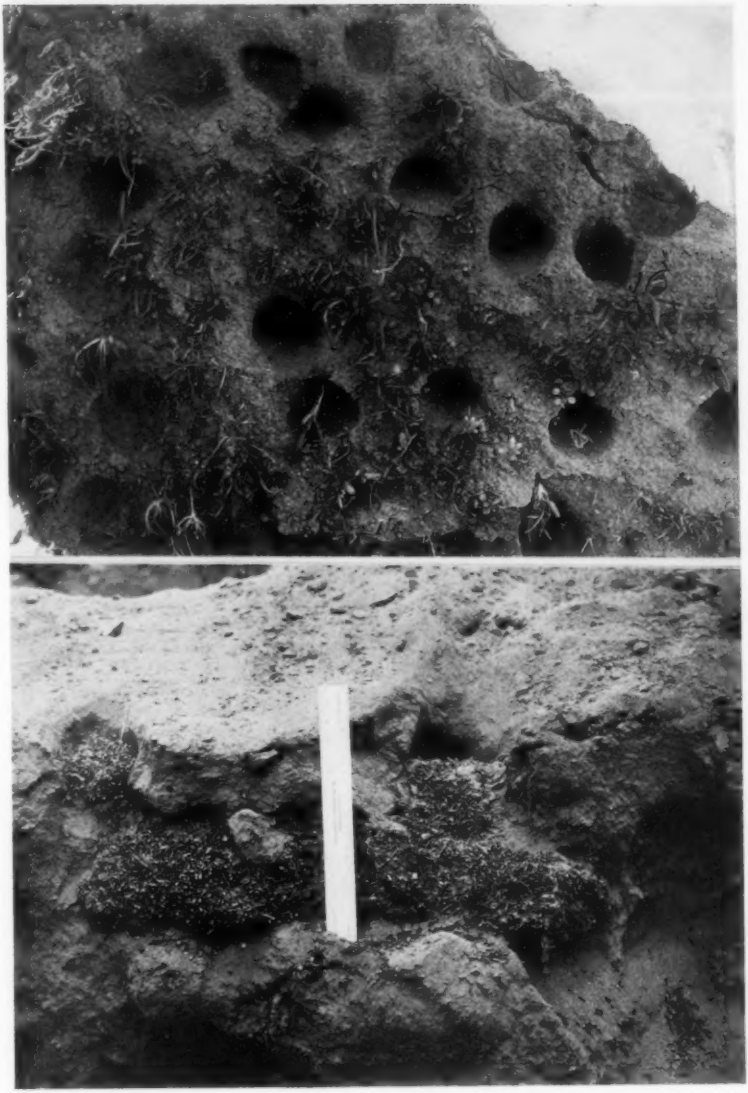
Further evidence that these surface-pit caches were being carried into the den was secured by observing the action of a Dipo on surface-pit den no. 1 of June 3, 1933. On the night of May 3–4, 1934, six adjacent surface-pit caches were uncovered to see what the response of the animal would be. Observations as follows were made: As when making a similar observation upon this den on June 2–3, 1933, nothing of note happened until 1 A.M., when a distinct drumming was heard. In a few moments it was repeated and this time my flash light revealed the Dipo. At first it was nervous and suspicious and went about cautiously gleaning over the ground surface. Its feeding ground was a couple of rods west of the den and to and from here it would travel at regular intervals of about 5 minutes out, pause a moment at the used entrance and disappear, to return after a much shorter interval. Occasionally it would forage over the surface of the den and when quite close one could hear the snap of (probably) dwarf seed-ladened pepper-grass plants which were later



THE GIANT KANGAROO RAT, DIPODOMYS INGENS AND ITS HABITAT

UPPER. Panoche Creek Canyon, California, December 10, 1933. The lack of vegetation is clearly shown here. The broken surface of the immediate foreground represents the den of a kangaroo rat, *Dipodomys ingens*; Den No 6, excavated on this date, was neighbor to the one in the foreground.

LOWER. Photo of living captive specimen, male, by William T. Shaw.



BURROWS OF THE GIANT KANGAROO RAT

UPPER. Surface-cache pits of *Dipodomys ingens* at Panoche Creek, California, March 21, 1933. Bird's-eye view showing surface-pits after all the pepper-grass seeds and pods had been removed. The illustration was made by cutting out a block of soil filled with surface-pits and standing it on edge.

LOWER. New underground-cache of *Dipodomys ingens*, Panoche Creek, California; Den No. 5, June 3, 1933. This cache contained 3¾ quarts of pepper-grass and filaree. Photos by William T. Shaw.

found by careful observation, partially buried with sand and dust, having been trodden under by the feet of many passing sheep. Now and then it would exhibit what seemed to be a playful movement, while returning from these nearby searches, by darting rapidly to the den entrance, striking the ground sharply with the hind feet with each hop, the force and sound diminishing with the approach to the den—a sort of anti-climax.

Once a visiting Dipo, or so it seemed, appeared in the outskirts of illumination and was promptly driven off.

Occasionally the six exposed caches, consisting of pepper-grass seed pods, were visited but no serious attention paid to them until nearly the end of the night when the animal began to take in the deposits. Back and forth it would go, carefully gleaning the uncovered pods and hopping briskly to its vertical entrance. Now and then it would sweep back the gleaned over dust with a side stroke of the hind feet. The last thing it did was to make 23 (the last 20 consecutive) trips, in carrying in these disturbed caches. The last trip and disappearance occurred at 4:25 A.M. and did not differ from the others. Examination a few minutes later showed the used vertical entrance plugged from the inside. Dipo's retiring was synchronous with the first cooing of a mourning dove, although a killdeer had been heard at 4 A.M.; morning was arriving.

The quarter moon had climbed our south lying hill at about 2 A.M. At 4:30 A.M. but one lone star remained. The voice of the raven was heard at 4:45, the linnet at 4:48, and the song of the meadowlark brought warmth to the gray bad-lands at 4:50 A.M.

One new idea we had gotten from this observation, extending continuously from 1 A.M. to 4:25 A.M., was that the Dipo was at this date apparently gleaning from other sources than his surface-caches, for it repeatedly visited and returned from gleaning over areas where the pepper-grass plants were found, now quite ripe, and sufficiently dry to permit of direct underground storing.

From the above it would seem that this careful and systematic method of gathering, curing, and storing food was being employed by this species of kangaroo rat. Whether or not it is employed by other species and varieties living under different conditions of soil and climate would be interesting to know. If so, it is indeed a vulnerable point in their annual cycle of activity, as was suggested by Miller on our return one evening from work through a cultivated area formerly known to have been inhabited by other species of this genus (Culbertson, 1934). So shallow are the surface-pits and so near the surface are many of the prominent underground-stores that a season or two of cultivation with heavy implements would make it difficult for the animals to exist.

LITERATURE CITED

BAILEY, VERNON. 1931. Mammals of New Mexico. U. S. Dept. Agric., North Amer. Fauna no. 53, pp. 1–412, pls. 22. March 1, 1932.

CULBERTSON, A. E. 1934. Rediscovery of *Dipodomys nitratoides exilis*. Journ. Mammalogy, vol. 15, no. 2, pp. 161–162. May, 1934.

GRINNELL, JOSEPH. 1932. Habitat relations of the giant kangaroo rat. Journ. Mammalogy, vol. 13, no. 4, pp. 305–320, fig. 1. November, 1932.

SETON, ERNEST THOMPSON. 1929. Lives of game animals, vol. 4, pt. 1, pp. xxii + 440, pls. 52, maps 12.

VORHIES, C. T., and WALTER P. TAYLOR. 1922. Life history of the kangaroo rat *Dipodomys spectabilis spectabilis* Merriam. U. S. Dept. Agric., Bull. 1091, pp. 1–40, figs. 3, pls. 9. September 13, 1922.

Fresno State College, Fresno, California.

WINTER FOOD HABITS OF COYOTES: A REPORT OF PROGRESS, 1933

BY CHARLES C. SPERRY

This progress report on food habits of coyotes is based on the examination of 2,584 stomachs collected in 10 western States during December, January, and February, 1931 to 1934. Analyses were made in the Denver Laboratory of the Division of Food Habits Research of the U. S. Biological Survey. Acknowledgment is made of the assistance of Shaler E. Aldous, Franklin H. May, and Cecil S. Williams, of the Denver Laboratory staff, who made many of the stomach analyses and prepared the preliminary tabulations. Of the 2,584 stomachs, 668 were empty, and 219 contained débris only. This leaves 1,697 on which to make an appraisal of the coyote's diet during the winter months.

Examination of stomachs continues to play a most important part in our study of the food habits of the coyote. Since experience has shown the shortcomings of field analyses of stomachs, all of our examinations are made in the laboratory. Some field work has been done and more is contemplated, as a knowledge of field conditions is necessary to a correct interpretation of laboratory findings.

From the 1,697 recordable stomachs that enter into the present study, taken during December (656), January (651), and February (390), the following summary has been prepared on the basis of frequency of occurrence of the various items. The accompanying illustration, however, gives percentages by bulk. The latter method of appraisal has long been standard in recording data on the food of numerous birds and mammals, and, since the percentages of all items aggregate 100, this method permits easy preparation of charts or graphs. It is often of greater importance, however, to determine the fre-

quency with which the coyote indulges in certain feeding activities than to know the bulk of the food it consumes on such occasions. This is particularly true when considering the coyote's relation to livestock, poultry, and game. For this reason, the following discourse will deal in terms of the frequency with which items have been found, while the figure presents volumetric estimates.

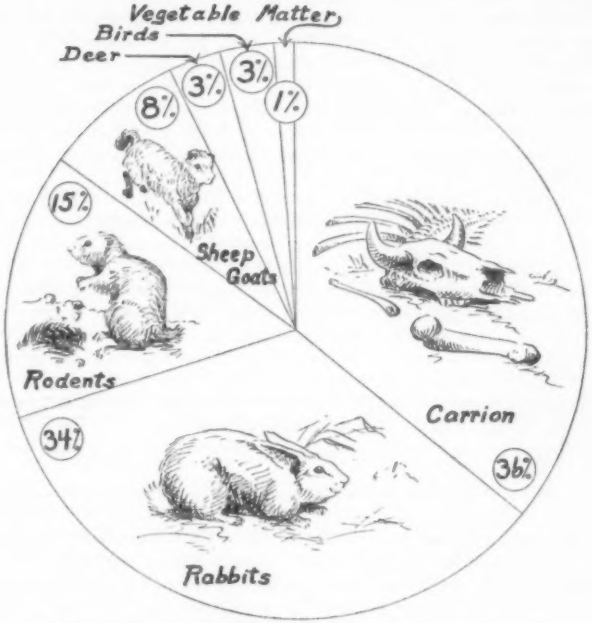


FIG. 1

CARRION.—It is not surprising to learn that carrion heads the list of the winter foods of the coyote, for with the advent of cold weather the coyote can find few of the small forms of life that constitute part of its regular warm-weather diet. Consequently an old dried carcass, even an empty hide, is likely to prove acceptable as food, with the resulting marked increase in the amount of carrion recorded. The greater part of this carrion food is derived from the remains of horses, burros, cows, coyotes, and sheep. In addition all known station material is placed under this heading. By the term "station" is meant the carcass of an animal used as a decoy, to attract coyotes to the spot where traps or poison have been placed. The kinds of carcasses used for station material vary greatly, in accordance with field conditions and the trapping technic of individual

Cultivated fruit was present in about 1 per cent of the stomachs, the 17 records being made by California and Washington coyotes. Apples were eaten by 10 coyotes and pears by 5. One California coyote made a full meal on figs, and another from the same State was responsible for the lone grape record.

Grass is a rare food item of the coyote.

The Denver Food Habits Research Laboratory continues to receive regular shipments of stomachs of predatory mammals from members of the Biological Survey's predatory-animal control force in practically all the Western States, and the examination of contents is progressing at the rate of approximately 500 a month. The next progress report will cover the food habits of the coyote during the spring and summer months. In the meantime, stomachs, not only of coyotes, but of other predatory mammals as well, collected at any time and obtained in any part of the country, including Alaska, will be gratefully received.

Denver Laboratory, Division of Food Habits Research, U. S. Bureau of Biological Survey.

STUDIES ON THE LIFE HISTORIES OF ZAPUS AND NAPAEOZAPUS IN NOVA SCOTIA

By Carolyn Sheldon

Two species of jumping-mice, *Zapus hudsonius hudsonius* (Zimmerman), and *Napaeozapus insignis insignis* (Miller), were studied in the vicinity of Lake Kedgemakooge, Annapolis County, Nova Scotia. A number of captive individuals were kept under close observation during the summer in the field, and during the fall, winter, and spring in the Museum of Zoology, Ann Arbor, Michigan. These two species of jumping mice were first kept in captivity in 1925, but careful field observations were made only in the summers of 1932 and 1933.

Before 1932 the small screen cages were provided with dry sand on the bottom and leaves or grass for nesting material. Evidently the atmosphere was too dry and the mortality of the mice was high, so near the end of the summer of 1932 I tried covering the bottoms of the cages with fresh earth, half of which was very wet. Green moss and ferns covered the damp part and dead leaves for nests were over the dry section. With the increased moisture I found that the mice survived much longer.

Large cages were used, beginning in the summer of 1933, and not more than 6 mice were placed in any one cage. The wooden bottoms were covered by 5 or 6 inches of fresh earth, on top of which were green moss, one or two moss-covered rocks, small dead logs, growing ferns, clumps of grass or sedge, a young balsam, and spruce trees. One section of the cage floor was covered with sphagnum mosses, gathered from the natural habitat and kept damp at all times. In such cages the mice lived from June through September, when they were sent to Ann Arbor.

For help and sympathetic interest in my work on jumping mice I wish to express my warmest thanks to Vernon Bailey. I am indebted also to the University of Michigan for laboratory facilities. My thanks are due to Lee R. Dice and Adolph Murie for their helpful interest and assistance, and to Paul Hickie for his care of some of the animals not under my personal observation. I am grateful also to Glover M. Allen, W. J. Hamilton, Jr., and Arthur Svihla for suggestions, and generosity in allowing me to make use of information.

OBSERVATIONS

Napaeozapus seems to occupy two distinct types of habitat. I have found it either near spring holes in sphagnum swamps, sometimes as far as half a mile from Kedgemakooge Lake, or in dry, hardwood forests on a shore covered with rocks or more often with thick, tall grass and sedge. Usually, in the latter situation, it was caught inside the fringe of the trees rather than out on the open shore. Whether or not it lives in the dry pine, hemlock, and hardwood forests back from the lake I do not know, as I never trapped very far from water or swampland.

The distribution of *Napaeozapus* is very local, separate colonies occupying not much more than 150 yards of shoreline. I cannot determine why this is so, as the surrounding environmental conditions are, as nearly as I can tell, identical. The distance along the shore between colonies varies from about a half mile to three miles. The number of colonies I have definitely located at Kedgemakooge is three, but I have taken single mice from a few other places, where colonies may occur. My records indicate that about eight *Napaeozapus* in a colony may occupy from 100 to 200 yards of shoreline.

An exception to the colonial distribution of *Napaeozapus* was found at Beaver Lake, a very small body of water about nine miles from Kedgemakooge. There the vegetation is almost the same as around Kedgemakooge except that bog and swamp plants are more abundant. At Beaver Lake *Napaeozapus* was caught in great numbers everywhere around the shore. Perhaps this can be accounted for by the lake's small size and the uniform favorable environment.

Zapus seems much more adaptable as to habitat than *Napaeozapus*. It is most abundant on hay meadows where the grass is thick and tall most of the summer. However, it was taken also along grassy shores with *Napaeozapus*, but never in the sphagnum swamps. Although in the hay meadows it seems to inhabit only the land near the lake shore it was found also two or three miles from the lake in clearings filled with sweet fern, pearly everlasting, hay-scented fern, and other plants that grow in a fairly dry habitat. The farmers in Nova Scotia report jumping mice to be commonly seen during haying operations. I have never caught them out in the open, but only around the edges under bushes. However, they are known to use the shelter of haystacks.

Zapus also is very local in distribution and in many places apparently suitable for it I had no success whatsoever during the two successive summers I have trapped in the region. I have located 5 distinct colonies of this species. Records for *Zapus* show also about 8 in a colony occupying from 100 to 200 yards of shoreline.

Runways are apparently used more by *Napaeozapus* than by *Zapus*. I have caught several *Napaeozapus* at the entrances of two or three small holes at the foot of large trees or in mossy banks overhung with shrubbery. On excavating three areas which were just inside a bank at the edge of the woods, I found that several holes used by one colony were connected by a network of underground runways. The burrows in places descended or ascended several inches, avoiding tree roots and rocks, but I did not find any nests below ground. Above ground, well-beaten runways also led from one hole to another and

Napaeozapus were caught frequently on these runways. However *Clethrionomys*, *Peromyscus*, and *Blarina* were also caught in the same runways so I do not know whether or not the *Napaeozapus* made them. In two instances I noticed a deep runway like a trench excavated for a distance of 7 or 8 inches from an entrance of a burrow. One trench was in a sphagnum swamp and led downward to a waterhole, while the other extended beside an above-ground tree root and then ended abruptly. In each of these places a *Napaeozapus* was caught. No other kind of mouse was taken in these trenches. Only once have I caught more than one jumping mouse at the entrance of a single burrow, although the openings remained clear and apparently in use all summer. Where no runways or burrow entrances were apparent, *Napaeozapus* seems to travel in well-beaten open spaces, under thick bushes, in beaver trails in bogs, and in the trails of deer or moose around the lake shore.

Zapus, on the contrary, seems to use runways less frequently. Only a few times do I remember catching it in mouse runways. It has been captured in beaver trails leading under alders from a grassy meadow to the shore, in open places not thickly overgrown with grass, but protected by high bushes, and beside fallen logs near the shore in hardwood forests. Once or twice I have caught *Zapus* in traps set with the entrance resting on an old board near the edge of a river. Occasionally it has been caught in runways also used by *Napaeozapus*, *Clethrionomys*, and *Microtus*.

The nests of jumping mice I have not found in the field. In captivity during the summer, both *Napaeozapus* and *Zapus* often hollow out the earth three or four inches deep in a corner of the cage and make a compact nest-ball out of grass or leaves. Most of these are built with the rounded top above ground. They are loosely woven usually out of dry grass, with only enough space inside to allow two or three mice to curl up and sleep close together. The location is usually at the foot of some bushes planted in the cage. In one cage I kept a small hollow log all summer, but it was not used for a nesting site, although nests were built under it. Occasionally both species will make a small hollow inside of grass sods. At other times they make no attempt to build a nest, but merely crawl under heaps of dead leaves. In the fall of 1933 a number of *Napaeozapus* and *Zapus* were transferred into outside cages sunk into the ground at the Edwin S. George Reserve near Pinckney, Michigan. After the first night two or three holes were visible mostly in the corners of the cages. Later the entrances were kept closed up with earth and could not be distinguished from the rest of the earth floor.

These captive jumping-mice use grass, leaves, tow, paper, excelsior, or shavings for nests. If cotton is provided they not only make no attempt to form a nest out of it or to chew it up as is customary with *Peromyscus* and *Clethrionomys*, but they have been found to eat it. This usually proves fatal, as the cotton fails to digest and thus clogs up the stomach. The stomach of one *Napaeozapus* was found to be filled with cotton which must have been eaten at least four days before death, as all cotton had been that long removed from the cage. Cotton also is a disadvantage to the mice because it becomes snarled about their long tails.

When suddenly startled, both species usually take two or three leaps toward the nearest protective cover and then sit motionless until pursued. It is easy to catch one by creeping up when he is sitting still. When outside the cage the mice often come out in plain sight on the floor of the room and even allow somebody to approach them slowly from the front. Only twice have I had the opportunity of observing any other mode of travel in the field. A trapped *Napaeozapus* quickly leaped out when I opened the trap and landed in a mossy hollow 5 or 6 feet from me. Contrary to the habits of *Clethrionomys* or *Peromyscus*, which run into the nearest hole the minute they are released, he remained immobile for a time, crouching against the side of a large rock. I made no effort to recapture him and finally he hopped, using all four feet, over to a fallen log, ran along it to the end, and disappeared under some rocks and tree roots. Later he

came out again on another log and then disappeared from view behind it. He moved very leisurely, apparently without concern for possible enemies, and stopped once or twice, rising on his hind feet to sniff around as if in search of food. He sniffed a small starflower plant at the entrance of a hollow log, but did not attempt to eat it, and then disappeared inside the log, reappearing at the other end. Not once did he jump or try to move quickly.

Another time I watched a *Zapus* hopping along in the woods, after she had been set free from a trap and had first taken two leaps to shelter. She used all four feet, the tail held just off the ground.

In captivity both species hop in the same manner around the cage unless frightened by a sudden movement, or when first transferred from a trap to the cage. Then they leap frantically against the wire, sometimes clinging to it with all feet and clambering around to find a way out.

My observations confirm the suggestion of W. E. Saunders in the November, 1921, number of the Journal of Mammalogy, that these mice may be partly arboreal in habits. I have found that both *Napaeozapus* and *Zapus* climb bushes with surprising sureness and agility. They climb all over the small evergreen trees in their cages, chasing each other among the branches, or often sitting on one of the limbs for five or ten minutes without moving, their long tails hanging down below them. Sometimes two or three can be seen in one small tree. The *Zapus* clamber over the rose bushes in their cages, the thorns apparently not hindering them. The *Napaeozapus* not only eat alder cones, which in nature grow two or three feet off the ground, but also the new green needles of spruces which, although sometimes available from very low branches, must require some climbing ability. Both species are unable to climb board walls, but both can run easily up a slanting beam.

The concealment of the jumping-mice in the woods, is, I believe, due to their ability to keep absolutely still for a long period of time. Both *Zapus* and *Napaeozapus* are not easily detected among the dead leaves of the forest or the brownish grass in the fields, but no matter what their color, they are easily seen when alarmed because their method of progressing in leaps renders them conspicuous.

Last summer I observed an example of the ability of *Zapus hudsonius hudsonius* to remain motionless over an incredibly long period of time. A female caught on July 15, 1933, was marked and released in the place where she was caught. Around the roots of a huckleberry bush 4 or 5 feet distant the dry leaves had gathered and when the *Zapus* left the opened trap she made two leaps, gaining this bunch of leaves, where she stopped and remained motionless. From 3:30 to 4:00 P.M. I sat perfectly still watching her and not once did she move. Her color so well blended with the leaves that I could not have seen her, had I not known that she was there. None of the sounds of frogs, birds, and other animals in the surrounding woods seemed to alarm her in the slightest and she did not move a muscle. Once the leaves above her moved to one side and let a small beam of afternoon sunshine strike across her back, but still she did not stir. At 4:00 P. M. she moved only to scratch her side with a hind claw and wash her face. Then she was still for ten more minutes, when she again washed her face and front paws and began moving her head from side to side looking all around. Apparently satisfied by this time that there was no danger, she turned around, hopped upon a small mound by her side and moved away on top of a rotten log behind which she disappeared without even the rustling of a leaf. Therefore, for a total of 40 minutes she made no noticeable movement.

The daily period of activity of these mice seems to be mostly from early dusk through the night, but it may include periods of daylight as well. In my traps I have caught most of them after dark, but occasionally some during the day. On May 31, 1933, a female *Napaeozapus* entered a trap some time between 9:00 A. M. and 3:30 P. M. It was

a cold, cloudy day with rain beginning to fall about 2:45 P. M. She was very thin, weighing about 20 grams.

Other daytime records for jumping mice include a *Zapus* seen in a field at midday and a *Napaeozapus* observed by my brother in an open bog during the day. Fairly often both species are seen abroad in the late afternoon and early evening. I have never found them to be very active in rainy weather, almost never catching them in traps at such times.

In captivity at first both *Zapus* and *Napaeozapus* come out of their nests to eat or drink just before dark. After a week or more in their cages they stay under the leaves until long after dark, sometimes not appearing until ten o'clock at night, unless the cages are equipped with circular wire wheels. In that case they often appear before dark and begin to run the wheels. This they keep up all night and often well into the morning. At first I suspected that the lights in the room where the cages were kept were causing them to keep under cover, but even after the mice were moved out onto the screened porch they could not be seen or heard when I visited it with a flashlight at intervals after dark. I have, at times, seen them feeding early in the morning.

The food is mostly vegetable. While watching the mice in the light of a flash at night I saw *Zapus* eat the seeds on the tops of meadow grass. Many kinds of grass and sedge were put in the cages and the next morning the seed tassels in the cages of both species were cut off and torn to pieces probably in order to reach the seeds. I have never actually observed them eat the stalks of grass, but I have seen them passing the stem of long grass through their mouths as though to squeeze out moisture. Although they drink a quantity of water, I believe that they obtain most of their required moisture from green plants. Certainly *Zapus*, which live miles away from the lake in dry meadows, must depend on green food for moisture. By accident I once transplanted a wet clod of growing buttercups into a cage of *Napaeozapus*. The next morning it was stripped bare and stems, leaves, and flowers of the plants were scattered about the cage and partly eaten. *Napaeozapus* seemed to show a marked preference for these buttercup plants, although those gathered from dry fields were generally not touched. Early in the spring I put in leaves, blossoms, and roots of the wild iris. The next morning part of the root was eaten, but nothing else touched. After a small spruce was planted in a cage of *Napaeozapus* I found it to be completely stripped of the new needles on the tips of the branches. Another tree was put in its place, but was not touched. Later in the summer a few green cones of the hoary alder were eaten by both species, but no great preference was shown for these. Wintergreen berries and huckleberries were eaten, but bunchberry and blackberries were not touched. I planted several different kinds of mushrooms among the moss and the only ones nibbled at were some red ones of the genus *Russula*. Some *Napaeozapus* caught in the hardwood forest, however, were miles distant from any of the above-mentioned foods.

In "Life Zones and Mammals of North Dakota" Mr. Bailey tells us that *Zapus* cuts grass into lengths of about three inches in order to reach the seeded tops. In 1926 I have a record of once finding long grass cuttings outside a hole in front of which I caught a *Zapus*. The mouse had apparently cut off the green tops of the grass blades and left them just outside his hole. In 1933 a *Zapus* in captivity cut a pile of grass into lengths ranging from a half to two inches. This grass had no seeds on it. Perhaps they cut grass to carry into the burrows and build nests out of it. In captivity I often noticed fresh grass carried to the nest and woven into it.

Other green plants which grow in their natural habitats were given to them, but none were eaten. Among these were cinnamon fern, royal fern, sensitive fern, brake fern, sphagnum and other mosses, alder leaves and stems, jewel weed, meadow rue, and violet leaves and stems.

Apples were eaten and cucumber and raw cabbage nibbled at, besides quantities of rolled oats and sunflower seeds kept in the cages at all times. They did not touch carrots, lettuce, or celery.

When eating, both species of mice squat on their hind legs and tail and hold the piece of food in the fore-paws. Apparently they bite off a seed, then hold it in their fore-paws, and transfer it to the mouth. When drinking they perch on the edge of a little can about two inches high with their hind feet grasping the rim. I never saw them reach up and bend over to drink. Their mouths were in contact with the water, but I was not able to see whether the water was lapped or sucked up into the mouth.

Apparently these jumping mice are not usually carnivorous. They never touched the dead bodies of their companions which died in the cages. In a few stomachs which I dissected I found some parts of insects, which unfortunately were not identified.

There seem to be conflicting reports as to whether or not these mice collect food stores. They are equipped with internal cheek pouches, but in captivity I have never found any evidence of storing. Occasionally they will carry seeds into the nests and eat them there, as shown by a few empty seed husks found under the grass.

Both *Zapus* and *Napaeozapus* can be handled easily and neither attempts to bite unless held by the tail or treated roughly. However, they appear to be nervous and high-strung and are therefore not very easily tamed. Toward each other their dispositions vary, but I do not believe they are belligerent except during the breeding season, when the females are apt to fight the males. Often the males lose most of their tails and sometimes their ears are torn and bitten. I have watched one female *Napaeozapus* chase two males around the cage for no apparent reason. The males would be sitting quietly in one part of the cage and she would jump at them and chase them until they crawled under the leaves. Not one dared come near her when she was feeding. Usually, however, they group together when feeding and seem to be entirely at ease with one another.

In captivity more than one jumping mouse is usually found in a single nest, but sometimes they sleep in separate nests. During the summer I have found three or more mice living in the same nest—no distinction being made between males and females. However, during the summer of 1933 I found sometimes that the females were occupying one nest and the males another. This was the first time large cages were provided—probably the small cages were too small to allow them to use separate nests.

Squeaks and fighting were never observed at the same time, but during the daytime I have heard squeaks issuing from a nest occupied by more than one mouse, but have not seen signs of any movement under the leaves.

When about to go into hibernation they squeak continuously if the nest is uncovered. The young are very vociferous just after birth. The voices of the adults are not harsh or shrill as is the case with *Microtus*, *Clethrionomys*, or *Peromyscus*, but are more like a soft clucking coming from the back of the throat.

The nests are usually kept very clean, so far as I could determine. The water dish is frequently used as a depository for droppings. The pelage is kept smooth and spotless by constant licking of the hair, unless they are feeling too weak after being a long time in the trap. In that case, they sometimes die and the fur is much stained. Usually when one has been in a bottle trap for several hours be becomes dirty and wet, but as soon as he is transferred to a cage he immediately gives several minutes to cleaning himself thoroughly—passing the long tail through the mouth and licking the fur all over.

When photographing these mice it was necessary to poke them around with a stick or piece of wire to get them in the right position. They reacted very quickly to a poke on the rump, but no amount of poking in front or on the sides will budge them after they have become accustomed to their surroundings. Until they become used to it, a sudden squeak or a sound such as the clicking of a camera will make them start.

They are considerably disturbed if blown upon and will do anything to escape a draft. When a light is suddenly turned on them at night they all immediately stop dead still wherever they are and look toward it, their ears pricked up and rigid. As long as the light is moved around they stay still, but if it is kept stationary and they become sure that it is harmless they usually slowly move toward their nest, after sniffing the air two or three times, and slide under the leaves, dragging the hind feet and tails after them until every part is concealed. I have never observed them to reappear while the light is on, although I have heard considerable rustlings underneath the surface of the leaves.

Both species sleep very deeply. After being only a few days in captivity, they are more or less on the alert, but after they have become accustomed to their cage it often takes considerable poking to make them leave their nests during the daytime. A *Napaeozapus* once escaped from the cage during the night and found his way into a knapsack hanging on the wall. He was sleeping so heavily that I did not find him until, after shaking the knapsack, he fell to the floor. Fully awakened by the fall he was off in a flash.

Jumping mice are attacked by several external parasites. In captivity fleas are very numerous on them and in their nests. After having been in captivity without much moisture they are subject to scab and their tails and ears dry up, while the hair on the rump and around the tail becomes very thin or is lost entirely. During the summer of 1933 they did not develop scab in the cages I used in Nova Scotia, but after being two months in inside cages in the Museum of Zoology at Ann Arbor, they all had that trouble. The earth in these cages was very dry.

I caught a female *Napaeozapus* in a snap trap on August 13, 1930, and a few hours after the dead mouse was removed from the trap a botfly larva (*Cuterebra fontinella* Clark) emerged from the posterior end of the body. Two small round holes were found in the skin, one just over the left forearm and the other, from which the insect emerged, near the tail.

The times of breeding have not yet been exactly determined by me. One *Napaeozapus* in captivity in June of 1925 contained 4 young, another 2, and a *Zapus* had only one. In 1930 a *Zapus* caught June 13 contained 6 young; a *Napaeozapus* caught June 26 contained 3. A *Napaeozapus* caught in a snap trap on June 20, 1933, contained 6 young in a very primitive stage. In 1933, four different captive *Napaeozapus* gave birth to litters—one of 5 on June 29, one of 5 on June 30, one of which I do not know the number on July 2, and a litter of 2 about September 11. The indication is that during the breeding season in Nova Scotia, each female probably has more than one litter.

I cannot be sure whether these mice actually mated in captivity or not because the period of gestation is not known. The mother of the litter in September was caught August 13, but kept in a large cage alone until shipped to Ann Arbor on September 8. She arrived 3 days later and the litter was found in the cage at that time. Since she must have mated before capture, the period of gestation in her case was 29 or more days. The other 3 litters were born after periods in captivity of 19, 23, and 22 days respectively.

No young were raised in captivity, for unfortunately every mother ate her young within 24 hours of birth. The mothers of the first two litters and the last were disturbed sufficiently to excite them and that may have caused them to eat the young, but the third litter was never examined. Its presence was known only by the faint whimperings which are heard after the birth of a litter. Ten days later there was no sign of young in the cage. The three females which gave birth to young in June and July were removed from the large cages to small ones about a week before the young arrived, and that change of environment may have caused the animals to act abnormally.

At birth the young *Napaeozapus* were dark pink and hairless with eyes and ears closed. Those taken from the first two litters each weighed just one gram.

Two of those belonging to the first litter were found drowned in the drinking water

can at the age of one day. Their measurements in millimeters were, respectively: Length, 41 and 44; tail, 11 and 13; hind feet, 5.5 and 6. The measurements of one found dead in the cage a few hours old in the second litter were: Length, 39; tail, 9.5; hind foot, 5.

On June 19, 1926, we found two *Zapus* torpid in bottle traps which they had entered during the night. It had been a cold night, but I do not know the exact temperature. Within a few moments of their removal from the traps they revived and remained active all summer. Two other *Zapus* caught that same night were fully conscious and lively. On August 24, 1932, I found a halfgrown *Zapus* torpid in a bottle trap. He remained active in captivity for the rest of the fall.

Before 1932 we gave a few jumping mice to Vernon Bailey in Washington, D. C. for him to study their hibernation. He writes as follows: "My experience has been that they require 50 degrees to 55 degrees F. for permanent hibernation. They awaken at 60 degrees. Abundance of moisture and a saturate air are necessary. Even then they will awaken at times famished for water and will drink and drink before going back to sleep.

"They will always die if they go to sleep with full stomachs but usually become sleepy with mild cold and do not become fully torpid for a few days.

"They should not be fed before being placed in a low temperature and it should be lowered slowly."

By October 12, 1932, four *Zapus* and one *Napaeozapus* were the only individuals I had to experiment with. They were marked, weighed, and placed in deep enamel pans with wire over the top. Damp earth and growing clods of grass were put on the bottom. Rolled oats, sunflower seeds, and water were provided. All cages were placed in a room in which there was running water all year, and no heat was ever turned on. I took temperature records each morning at 9:00 A. M. At that hour in the morning the temperature was about 60 degrees F. It never went below 48 and averaged about 55 degrees. The *Zapus* soon went into hibernation—the *first* on October 31 at a temperature of 56 degrees, the *second* November 1 at 57 degrees, a *third* on November 9 at 61 degrees and the *fourth* November 18 at 57 degrees. Two died November 21 and two more on January 3. In two cases the stomachs were full of food. After that I removed food from the cages for a long period of time after the mice went into hibernation and two that died were so thin that they may have died from lack of sufficient nourishment. They did not stay entirely torpid all the time, awaking at intervals apparently without regard to the temperature.

The *Napaeozapus* had gained rapidly from 26.5 grams on October 12 to 39 grams on December 1, and then lost to 23.5 grams on February 14, the date of death. He did not go into hibernation until February 13, 1933. He hibernated for one day and night and died the second night. On January 20 his cage had been placed on the windowsill and the temperature, which was fairly constant inside the room, fluctuated from cold to warm very rapidly outside, and several times it was so cold that his drinking water froze and once snow sifted in the cage.

All the mice lost weight very rapidly after becoming dormant. One *Zapus* that weighed 31 grams before going into hibernation went down to 28 grams in 50 days, at which time he died. The second mouse weighed 26.5 grams and in 60 days went down to 17 grams, when he died. The third reduced in 40 days from 34.5 to 23.5 grams, when he died, and the fourth in 60 days reduced from 34 to 19.5 grams at the time of death. The maximum amount of weight lost by any of these hibernating *Zapus* was 14.5 grams in 60 days.

On December 6, 1932, various short, trench-like excavations had been made in the cage containing two *Zapus*, which were found hibernating in the morning. These tunnels led almost to, and under the grass nest on the surface. On the 7th, the entrances to the burrows had been filled up, but the hollows under the nest were still there.

It is quite possible that *Napaeozapus* needs colder weather than *Zapus* to go into hibernation. I have never in the field caught a *Napaeozapus* in a trap and found him torpid, although the morning temperatures have been as low as 50 degrees F.

In the fall of 1933 I had 6 *Napaeozapus* and 10 *Zapus* for experiment. On September 29, two males and one female *Napaeozapus* and two males and one female *Zapus* were transferred to outside cages at the Edwin S. George Reserve near Pinckney, Michigan. The cages were 5 x 2 x 2 feet in dimensions, made of ½-inch hardware cloth and sunk one foot in the ground.

On October 3, two males and one female *Napaeozapus* and one male and one female *Zapus* were transferred into an outside cage in Ann Arbor.

The remaining mice, four males and one female *Zapus*, were kept in the Museum of Zoology. The first discussion concerns only these five.

On October 12, three males and one female were placed in a room where there was no heat ever turned on. The fourth male was kept in a heated room.

The conditions were identical with those of 1932–1933, except that 3 mice were put in open cages instead of deep enamel pans, and one kept in a heated room. Also, succulent food, in the form of apples, as well as dry food, was provided.

All the male *Zapus*, including the one in the heated room, went into hibernation on October 21, 23, and November 6, with temperatures at 60, 62, 55, and 72 degrees F., respectively. The last figure was the constant temperature of the heated room. The average temperature of the cooler room was 57 degrees F., with 46 degrees as the lowest recorded and 75 the highest.

The female did not once hibernate, but remained normally active and partook of food until she died on February 16, after a period in captivity of 36 weeks.

The others were found to hibernate irregularly, awakening for periods varying from 1 to 46 days at a time.

Temperature apparently had little or no effect on their hibernation, the average being equal for times of dormancy and activity.

With regard to food, all the mice ate a quantity of apple all winter. Between the hibernating periods often dry food was not touched unless the mouse remained awake for several days. They were found to eat as soon as they awoke and were observed eating apple late in the morning rather than waiting until night, their normal period of activity. Wheat sprouts were supplied after December, but only the seeds from which the green blades sprouted were eaten. One or two blades were carried into the nest and woven into the excelsior.

Occasionally one mouse would move 2 or 3 inches from his regular hibernating place after a period of awakeness. Frequently the mice were found fully awake at 9:00 A. M. and deeply hibernating again at 5:00 P. M. the same day. One escaped from his cage at night and was so lively in the morning that I was unable to capture him. That same evening at 5:00 P. M. he was found hibernating on the open floor.

In a cage containing two mice, often one would be awake and lively while the other was hibernating. They always occupied the same nest, the active one frequently completely on top of his dormant companion.

The weights were found to fluctuate with no regard as to hibernation or amount of food eaten.

The claws on nearly all of them grew abnormally long, even impeding their progress over the floor of the cage, but this may have been due to bad cases of scab. I sprayed them with kerosene from time to time and cut off the claws which threatened to curve under and up into the flesh of the foot. By the end of February all the cases of scab had improved and by May only their tails remained dry and a bit swollen at the base.

Besides the female which died February 16, 1 male *Zapus* died on March 10, after 40 weeks in captivity. All mice were awake February 13, 1934, and did not hibernate again.

From my notes I am not able to correlate the facts concerning any two mice. They all vary under nearly the same conditions. One hibernated off and on for a period of 103 days, another for a period of 87 days, a third for 11 days, and a fourth for a period of 34 days, while one did not hibernate at all.

The lack of sufficient humidity undoubtedly has something to do with my failure to keep them hibernating constantly; perhaps, also, there was a deficiency in diet.

Mr. Hickie very kindly made observations on the mice kept at the George Reserve. The following notes by him relate to the *Napaeozapus*.

When transferred into the outside cage they soon burrowed underground and plugged up the entrances of the burrows. Food and other general habits were recorded until October 21. Before that date they were observed to eat apple, corn, and quantities of sunflower seeds. Grass, sedge, pondweed, and moss were not touched.

On October 12, Mr. Hickie noted that they had not been seen for days, but that dirt was thrown over the food. On the 17th a leaf of lettuce had disappeared and on the 21st another lettuce leaf was partly eaten.

Nests were made out of shavings and one was built directly under a pan that was left in the cage. The droppings were deposited in the water dish.

From October 11 to 25 temperatures were taken between 8:00 A. M. and 3:00 P. M., the maximum average being 61 degrees F., and the minimum average 36.

On December 3, 1933, Mr. Hickie dug up the *Napaeozapus*. They were found hibernating in nests of shavings, each in a separate burrow about 8 inches under the ground. As soon as they were brought into a warm room they awoke. On December 4 they were put into a small cage at the Museum of Zoology where they hibernated irregularly from December 20 to February 28, the last day of hibernation. As long as one or more were awake seeds and apples were kept in the cage.

All three remained huddled together in a single nest of excelsior and when hibernating often remained stretched out instead of curling up in the usual position of a ball with the nose tucked under between the hind feet and the tail coiled around the body. Nearly always those which were awake were found on top of the others.

The weights of these mice fluctuated only slightly from the date of capture in June until the following December, when they were removed to the Museum of Zoology, but after that time the weights rose rapidly to almost double their original amount and remained fairly constant. This may have been due to lack of exercise.

On April 18, 1934, Dr. Murie dug in the cage containing the *Zapus* at the George Reserve. The burrow, about one-fourth inch in diameter, was discovered near the top, but ended at a depth of a few inches, the remainder probably having caved in. The nest chamber, 4 inches in diameter and 3 inches deep, was about 8 inches below the surface. An opening in it led to a smaller alcove 2 inches in diameter and about 6 inches from the surface. In the larger cavity all three *Zapus* were found curled up in hibernating position, but only one was alive. No nesting material had been carried down, but the chamber was in good condition although the soil was moist. Temperatures during the winter had occasionally dropped below zero and had frequently been below freezing. At one time several inches of rain water formed a puddle over the earth in the cage.

The live *Zapus* was put into a cage and revived somewhat, although his breathing was very irregular and when he moved he shook violently all over. He nibbled a little apple, but would not touch dry food. He was removed to the Museum of Zoology on April 24 and was still in a weak, lethargic condition, weighing 13.5 grams—a loss of only 6 grams since the date of capture, September 2, 1933. The first two days he remained outside of his nest, huddled up against the dish of water. When I placed him in a cooler room he stayed in the grass nest where he lay almost motionless, breathing only at intervals. On April 27 he died, having been 34 weeks in captivity.

Those in the outside cage at Ann Arbor were dug up April 14, 1934. Of the 5 placed

there, only 2 were found and both were dead. They were rolled up in hibernating positions, each in a separate nest of leaves, which were very sodden. Perhaps these mice were drowned by rain and melting snow. Although the ground through which their burrows had gone was soft and easily excavated, there were no signs of holes nor were there any nest cavities—merely a bunch of rotten leaves and grass. One was about 10 inches and one 8 inches below the surface.

I think that in the wild, hibernating burrows are probably dug in a bank or some place from which the rain water and melted snow can drain off.

At present (May, 1934) I still have 3 male *Zapus* and a pair of *Napaeozapus*. One male *Napaeozapus* was occupying a separate nest from the other two for three or more weeks after the end of the hibernation period. On April 21st he was found dead. He may have been killed by the others. He had been about 45 weeks in captivity.

The remaining *Zapus* have now been in captivity 35, 48, and 49 weeks. The *Napaeozapus* have been each 48 weeks in captivity.

Museum of Zoology, University of Michigan, Ann Arbor, Mich.

COLOR ABERRATIONS IN THE POCKET GOPHER AND THEIR PROBABLE GENETIC EXPLANATION

TRACY IRWIN STORER AND PAUL WALLACE GREGORY

Since man first interested himself in wild animals those individuals exhibiting color abnormalities have possessed for him a peculiar fascination. Primitive peoples often attributed supernatural power or import to such individuals. Students of natural history have ordinarily been content to dismiss color aberrants with designations such as "albino," "partial albino," "melanistic," or to describe them in detail, after which such "off-color" specimens have been consigned to the storage cases of museums without further consideration. During the past two or three decades animal geneticists have learned much concerning the factors involved in the production of the coat color in laboratory mammals, especially in the domesticated stocks of the Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), guinea pig (*Cavia porcellus*), and European gray rabbit (*Oryctolagus cuniculus*), as summarized in recent papers by Castle (1930a, 1930b), Castle and Sawin (1932), Haldane (1927), and Keeler (1931). A lesser body of information is available for the black rat (*Rattus rattus rattus*). Only in limited degree have the results of this genetic analysis been used in attempts to interpret color abnormalities observed in wild species (see, for example, Dunn, 1921; Hatt, 1930). We here describe certain color mutations in wild pocket gophers of the genus *Thomomys*, chiefly as observed in specimens taken in California, and attempt to interpret these in terms of the genetic factors that have been found to produce changes in the coloration of the small domestic mammals just named.

Considerable parallelism has been shown to exist in the factors controlling the coat coloration of the laboratory mammals mentioned. Genetically this is interpreted to mean that homologous genes are operating in the production

of at least certain of the color aberrations discovered in these species. In wild gophers we have seen no color mutation that does not have a phenotypic counterpart in one or another of the domesticated species. Further, the normal color patterns of many wild species, including the pocket gophers, can be explained on the basis of interaction of the several factors already ascertained to be operative in production of the "wild" coat color of the species that have been studied under domestication.

One serious obstacle to confirming the inferences that we have made respecting the genetic foundation for color abnormalities in the pocket gopher lies in the fact that to date, no one, so far as we are aware, has been able to breed these fossorial rodents in captivity. Attempts under the supervision of one of us (T. I. S.) have thus far been unsuccessful.

ACKNOWLEDGMENTS

Besides several specimens in the collection of the Division of Zoology at Davis we have had access to the collections of the Museum of Vertebrate Zoology of the University of California at Berkeley, and of the California Academy of Sciences in San Francisco, and have borrowed from the private collections of Ira N. Gabrielson and Stanley G. Jewett of Portland, Oregon. To the officers of the two museums and to the individuals named we are under obligation for the use of specimens that have helped to elucidate the problem here discussed.

MATERIAL

The specimens used are listed in Table I.

COLOR ABERRATIONS AMONG WILD POCKET GOPHERS

The normal coat of the pocket gopher is typical agouti, with black and yellow markings on each hair. Numerous local races of this animal have been recognized taxonomically, some of which differ markedly from one another by the tone of coloration, some being quite blackish, others with a greater admixture of red. We are not concerned here with this geographic variation but only with abrupt departures or mutations in particular individuals that set them apart from the norm of the respective local populations to which they belong. Our interest in the subject was aroused by the capture, in the vicinity of Davis, of several individuals markedly different in coloration from the local population (*Thomomys bottae navus*).

The first of these (DZCA 165) was taken in an alfalfa field near the town, when flood irrigation was in progress during 1927. For several years, in fact until 1931, this was merely considered an unique mutant of a self colored intense red. But in January, 1931, two additional specimens were received, which were captured 11 days apart by a domestic cat belonging to the household of a University staff member. Presumably they were taken on University land and within a half mile of the source of the 1927 specimen. These, however, were dilute red (self dilute yellow—light ochraceous buff in actual color). A second intense red specimen was captured about 8 miles southeast of Davis in June, 1932, and a third of dilute red about 2 miles to the west of the campus in January, 1933. Meanwhile, on March 12, 1932, in Davis, a light drab colored individual was captured that was sharply different from the normal local population and also from the mutants previously obtained.

Our interest being thus aroused in the color mutations in this species we proceeded to examine the collections of the Museum of Vertebrate Zoology of the University of

TABLE I

Specimens of pocket gophers (Genus Thomomys) discussed in this paper

COLLECTION AND NUMBER[1]	SPECIES OR SUBSPECIES	LOCALITY (CALIFORNIA EXCEPT AS NOTED)	DATE COLLECTED	GENERAL COLORATION	PROBABLE GENETIC CONSTITUTION AND DESCRIPTION
MVZ 21917	*niger*	Mercer, Oregon	May 1, 1915	Black	aa non-agouti
MVZ 21918	*niger*	Mercer, Oregon	May 4, 1915	Black	aa non-agouti
MVZ 19015	*townsendii townsendii*	Nampa, Idaho	Aug. 30, 1912	Black	aa non-agouti
MVZ 37486	*bottae bottae*	5 mi. s. Martinez, Contra Costa Co.	Apr. 27, 1927	Black	aa non-agouti
CAS 4220	*bottae navus*	Woodland, Yolo Co.	Aug. 23, 1922	Black	aa non-agouti
MVZ 19194	*bottae pallescens*	Monrovia, Los Angeles Co.	June 4, 1913	Black	aa non-agouti
DZCA 165	*bottae navus*	1/2 mi. se. Davis, Yolo Co.	Sept. 27, 1927	Orange-buff to capucine orange	ee C red
DZCA 173	*bottae navus*	8 mi. se. Davis, Yolo Co.	June 18, 1932	Orange-buff to capucine orange	ee C red
DZCA 167	*bottae navus*	Univ. Farm, Davis, Yolo Co.	Jan. 19, 1931	Light ochraceous buff	ee c^d dilute red
DZCA 168	*bottae navus*	Univ. Farm, Davis, Yolo Co.	Jan. 30, 1931	Pinkish buff to warm buff	ee c^d dilute red
DZCA 174	*bottae navus*	2 mi. w. Davis, Yolo Co.	Jan. 14, 1933	Light ochraceous buff	ee c^d dilute red
DZCA 170	*bottae navus*	Davis, Yolo Co.	Mar. 12, 1932	Light drab	E c^d dilution
CAS 415	*bottae pascalis*	Modesto, Stanislaus Co.	May 22, 1911	White; local pale-colored areas	En c^d English spotting and dilution
MVZ 21088	*bottae bottae*	Richmond Dist., San Francisco	Apr. 10, 1914	Sooty black	pp aa pink eyed dilution and non-agouti (eye color not recorded)
CAS 4219	*bottae navus*	Woodland, Yolo Co.	Aug. 23, 1922	Sooty black	pp aa pink eyed dilution and non-agouti (eye color not recorded)
CAS 2673	*bottae bottae*	San Francisco	June 17, 1920	White	cc albino

CAS 2815	*bottae bottae*	Balboa Park, San Francisco	Nov. 20, 1919	White	cc albino
CAS 2814	*bottae bottae*	Fell St., San Francisco	Aug. 20, 1919	White	cc albino—eyes pink
MVZ 35346	*bottae bottae*	Del Monte, Monterey Co.	Oct. 21, 1921	White	cc albino
MVZ 31095	*bottae bottae*	Daly City, San Mateo Co.	Jan. 26, 1920	White	cc albino—eyes pink, teeth and claws normal
MVZ 33008	*bottae bottae*	Byron, Contra Costa Co.	Nov. 11, 1922	White	cc albino-eyes pink, nosepad and feet flesh color
MVZ 31794	*bottae mewa*	Dudley, Mariposa Co.	July 13, 1920	Mid-back white	Dutch spotting
MVZ 28294	*bottae pascalis*	Sw. of Bakersfield, Kern Co.	May 3, 1918	White rt. dorsal	Dutch spotting
MVZ 16497	*perpallidus*	Palm Springs, Riverside Co.	Feb. 10, 1912	Midcrown white	Dutch spotting
MVZ 16641	*bottae puertae*	La Puerta Valley, San Diego Co.	Feb. 26, 1912	Interscap. longi., white	Dutch spotting
MVZ 22482	*bottae mewa*	3 mi. ne. Coulterville, Mariposa Co.	June 3, 1915	Left back white	Dutch spotting

[1] CAS = California Academy of Sciences, San Francisco.
DZCA = Division of Zoology, College of Agriculture, University of California, Davis.
MVZ = Museum of Vertebrate Zoology, University of California, Berkeley.

One specimen of *Thomomys bottae bottae* (CAS 2813) from San Francisco, collected January 17, 1920, has the pelage drab to hair brown; we are unable to diagnose its probable genetic constitution, in the present status of our knowledge, and, therefore, omit it from the paper.

California at Berkeley and of the California Academy of Sciences in San Francisco for specimens of pocket gophers showing abnormalities.

This examination showed that such abnormalities among wild pocket gophers in California are uncommon. Among the more than three thousand specimens of this group in the collection of the Museum of Vertebrate Zoology there were only 11 from California that showed "melanism," "albinism," or "spotting." Only five of these, all of them instances of white spotting, were taken by museum collectors in regular field work. The others, "blacks" and "whites," were individuals which, because of their peculiarities, had caught the attention of persons in various parts of the state and resulted in the sending of the animals to the Museum for preservation. No museum field collector seems ever to have encountered any of the mutations (other than that of white spotting) reported in this paper. The same seems to be true of the collection of the California Academy of Sciences.

Among more than one thousand pocket gophers, trapped in routine cleanup on the University lands at Davis in 1932 and 1933 and examined by one of us (T. I. S.) for other purposes, there was no color mutation of any sort. Among upwards of 500 collected on Straloch Farm, just west of the University Farm, in 1933 and similarly examined, only one (DZCA 174) showed color peculiarities.

Since our interest was first aroused in color abnormalities among pocket gophers we have made many informal inquiries on the subject. As a result we have had report of additional individuals, not seen by us, but evidently resembling or identical in character with some of the specimens here described, from localities still farther away, but contiguous to this region. Mr. W. D. Norton, Farm Advisor for Yolo County, reported on March 20, 1933, that Mr. Sidney Leathers, who lives in the country toward Knights Landing, has seen "golden" gophers on several occasions; also that a similarly colored specimen from the Sutter Basin was mentioned by the Knights Landing correspondent of the "Woodland Mail" in February, 1933. Two or more residents of Davis have told us of seeing peculiarly colored gophers at times within the past several years.

Published records of color mutations in pocket gophers, other than for black individuals or stocks, and for white-spotted or albino specimens (see Bailey, 1915), are relatively scarce. Burnett (1925, p. 129) reports one specimen of *Thomomys talpoides clusius* in Larimer County, Colorado, which was "deep cream, lighter beneath, with large white throat-patch; tail light; feet and legs almost white."

Two inferences seem justified here: (1) color aberrations are of relatively rare occurrence on a percentage basis, and 2) several mutant factors seem established in the pocket gopher population about Davis. The fact that individual pocket gophers showing double mutations have been collected in localities several miles apart would suggest that these mutations occurred at some considerable time in the past. These animals are believed not to migrate far. The occurrence of double mutants of presumed recessive character therefore argues for a relatively widespreading of heterozygous stock in the neighborhood of Davis.

PARALLEL COLOR MUTATIONS IN RODENTS AND LAGOMORPHS[1]

Rats, mice, guinea pigs, and rabbits have shown many mutations which affect coat color and color pattern. The genes which belong to the albino allelomorph series, the extension series, and the agouti series, mutate more frequently than other genes, and may be considered rather unstable. In these mammals eight mutations have occurred in the albino series of allelomorphs, four in the extension series, and five in the agouti

[1] The authors recognize the usual ordinal distinction between "rodents" and "lagomorphs," but for brevity have alluded to all the small laboratory mammals as "rodents."

series. Not all of these mutations, however, have been found in any one of these species that has been analyzed genetically, but each contains several mutations which are considered homologous with those in others of the group. For the benefit of the reader who is not familiar with the morphological expression of the genes considered here we shall discuss them briefly.

The mutations of the albino allelomorph series are C, c^k, c^d, c^{ch3}, c^{ch2}, c^{ch1}, c^H, c, named in order of dominance. Of these the gene C, highest in the series and dominant to all the others, causes both black and red pigment to be present in the hair, and a maximum amount of dark pigment in the eyes. The gene c^k, reported only in the guinea-pig, causes black and red pigment to be present in the hair, but dilutes the red to a pale yellow. In the mouse and guinea-pig c^d causes a paling dilution of the black and red pigment of the coat but does not dilute the pigment in the eyes to any appreciable extent, as determined from microscopical examination. The ruby-eyed dilution, c^r (homologous with the c^{ch} series in the rabbit), found in all four species named above, causes red pigment of the hair to disappear, without substitution of other color, and in consequence that part of the coat which is yellow under normal conditions becomes white. This gene dilutes black in the fur slightly, and in some animals reduces the amount of pigment in the eyes so as to give them a reddish or ruby appearance from which character the gene is named. Himalayan albinism, c^H, is found only in the guinea pig, rabbit and cat (Keeler and Cobb, 1933). In its presence the coat is devoid of color but the extremities (nose, ears, foot pads and tail) are black or chocolate, and the eyes are pink. Complete albinism, c, appears in the rabbit and in all the rodents named above, except the guinea pig. When c is present no appreciable amount of pigment is found in the hair or eyes.

The allelomorphic series which affects the extension of black or chocolate is E^D, E, e^p, e, in order of dominance. Not all of the mutations in this series have appeared in any single species of laboratory mammal except the rabbit. The gene E^D is extreme extension and is epistatic to the agouti factor. Animals which carry E^D either lack the yellow band in the hair completely or else have a very narrow yellow band which shows on only a comparatively few hairs. This gene has been found only in the rabbit and black rat. E, the second allelomorph of the series, causes ordinary extension of black or chocolate pigment throughout the coat, and is found in the rabbit, black rat, and guinea pig. It may be present in the mouse and Norway rat, but has never mutated to any other form and as a consequence all individuals of these species theoretically are homozygous for E. The third allelomorph, e^p, is partial extension; under its influence black is extended only partially through the coat, red appears in the unextended portion, and the blending of the two colors produces a brindling effect as seen in the "tortoise" condition in the guinea pig and the "Japanese" condition in the rabbit. With e, the lowest allelomorph of the series, the coat color of the animal is red, since neither black nor chocolate is extended. This mutation is known in the black rat, guinea pig, and rabbit.

Five mutations have occurred in the agouti series of allelomorphs: A^y, A^w, A, a^t, a, in order of dominance. Of these A^y, the highest, occurs only in the mouse and causes the hair to be almost completely yellow; it is lethal in the homozygous state. The A^w allelomorph has been found in all the laboratory species of rodents and causes a gray condition with a yellow or light color on the belly. The third allelomorph, A, found in the mouse, black rat, and guinea pig, causes a yellow band to be present on all the hairs of the body, including those on the belly. The factor a^t has been identified only in the mouse and rabbit; it causes the black-and-tan condition of these animals. The lowest allelomorph of the series is non-agouti, a. In its presence black hair lacks a yellow (or white) band, in consequence of which the fur is black (or chocolate) in color.

since the two types of variations (yellow and dilute agouti) so closely resemble the condition found in the guinea pig we think it is highly probable that the variation is caused by the c^d dilution, the third mutation of the albino series of allelomorphs. The c^d dilution has been found in the mouse and guinea pig only, while blue dilution, d, has been found in the mouse, rats, and rabbit. The fourth mutation of the series, the c^r dilution, where black remains in the coat but yellow is absent, was not found, nor did we see evidence of Himalayan albinism, C^H.

Complete albinism, c, was present in six individuals of *Thomomys bottae bottae*. Of these an albino male (MVZ 31095), was captured near Daly City, San Mateo County, January 26, 1920. The field notes concerning this individual state that the eyes were pink. A second albino (MVZ 35346) was captured October 21, 1921, at Del Monte, Monterey County. No reference was made to the color of its eyes, but since it is self white, we feel safe in classifying it as an albino. The third (MVZ 33008) was captured at Bryon, Contra Costa County, November 11, 1922. The field notes state that the eyes were pink and that the nose pad and feet were flesh colored. The remaining three specimens were captured in San Francisco. The fourth (CAS 2814) taken August 20, 1919, had pink eyes and white feet. The fifth and sixth (CAS 2673 and 2815) were captured June 17, 1920, and November 20, 1919; there are no notes regarding the color of the eyes or feet, but we feel safe in regarding them as true albinos, c. We do not believe that the occurrence of three albinos in San Francisco and a fourth nearby at Daly City has any particular significance. The nearness of the California Academy of Sciences and tendency of laymen to report abnormal specimens may well account for the situation. Other instances of white gophers have been reported to us verbally; one specimen was seen at Santa Rosa, Sonoma County, on March 10, 1925, which had been in captivity for two years, and another was reported there; both were taken north of the city. No data were recorded as to eye color. In the pocket gopher there are apparently three identifiable factors in the albino series of allelomorphs, namely C, c^d, and c.

EXTENSION SERIES OF ALLELOMORPHS

With the exception of the six albinos just mentioned, all of the other specimens of pocket gophers examined from the museum collections were extended, E.

However, five self red gophers (*Thomomys bottae navus*) have been collected at or nearDavis. The first specimen (DZCA 165), was an intense self red. The next two (DZCA 167, 168) were dilute self reds. The fourth was intense self red (DZCA 173) and the fifth, a dilute self red, was taken 2 miles west of Davis (DZCA 174).

The first of these Davis specimens has a dorsal coloration between orange-buff and capucine orange; the under surface is ochraceous buff (colors after Ridgway, 1912). There is no trace of black on the animal, *anywhere*. About the mouth, the vent and on the feet are white areas about as in normal individuals. A distinct "molt line" across the rump, from thigh to thigh, shows little difference in color between the new and old coats.

The next two specimens are similar to the preceding, in lacking black markings, but are distinctly paler both above and below. In these the dorsal coloration is light ochraceous buff, the sides of the body and ventral area pale pinkish buff in one, with admixture of white in the other (colors of Ridgway, 1912). In only the second of these was the eye color recorded—it was dark as in normal individuals of this species.

There are two methods of explaining the red mutation in the gopher. The A^y (lethal yellow) mutation known only in the mouse offers an unlikely explanation. The most plausible explanation is a mutation in the extension gene from E to e. This mutation has occurred in the rabbit, guinea pig and black rat. Until breeding tests are made these five self red gophers will, therefore, be considered as due to a mutation from ex-

tended (E) to non-extended (e). This means that gophers probably have two of the four known allelomorphs of the extension series, E and e.

It seems that a relatively large percentage of the gophers of the Davis area carry non-extended (e) in the heterozygous state. The three dilute self reds are of more than passing interest since each also carries a mutation for dilution.

AGOUTI SERIES OF ALLELOMORPHS

Of the five allelomorphs of the agouti series which have occurred in the species of laboratory rodents and which have been analyzed genetically by breeding tests, two are evidently present among the pocket gophers. All the gophers in the Museum of Vertebrate Zoology and California Academy of Sciences collections that showed agouti had distinctly ticked bellies and narrow bands of subapical red on the hairs of the dorsal surface of the body. We are not certain whether it is the A^w or the A gene which is found in the wild gopher. It may be that the third allelomorph of the series, A, is responsible for the agouti pattern. This allelomorph is found in the mouse, black rat and guinea pig and was introduced by Professor Castle and his students into the domestic guinea pig (*Cavia porcellus*) through the species *Cavia rufescens*. In its native state the normal color pattern of the common guinea pig is agouti but the two different forms of agouti are found in the wild state of different species of the cavy.

The phenomenon of all black coloration, "melanism" of the mammalogist, "non-agouti" of the geneticist, has been observed in a number of species and subspecies of pocket gophers. Bailey (1915, pp. 21–22) reports one or more fully black individuals in *Thomomys bottae* ssp., and in the species *toltecus, fulvus, rufescens, talpoides, peregrinus, umbrinus, orizabae, townsendii* and *niger*, to which we can add *T. b. pallescens*. For all but three of these species the condition is unusual and probably of relatively infrequent occurrence. Bailey reports that 14 of 16 specimens of *orizabae* from the type locality were black, 5 in 17 of *townsendii* from southern Idaho were black, and *niger* is known only in the black condition. Ira N. Gabrielson, of Portland, tells us that he has never seen any but black specimens of *niger*. With regard to *townsendii* the following statement by A. W. Moore of the U. S. Biological Survey (forwarded by Mr. Gabrielson) is pertinent:

"*Thomomys townsendii townsendii* contains many black specimens in the vicinity of Deer Flat, near Nampa, Idaho. As near as I could learn from ranchers and specimens taken, about ten per cent are black. Ranchers, however, call them 'blue' gophers in that vicinity. This area covers about half a township at least. This same species in the vicinity of Pocatello apparently contains no black specimens. This is based upon reports received from crews that have trapped thousands." (Letter of December 18, 1931.)

From these observations we may conclude that *niger* has become homozygous for the black, non-agouti, condition, that *townsendii* shows local differences in the frequency distribution of this mutation, that *orizabae* possibly has a high percentage frequency of the mutation, while in the pocket gopher population elsewhere this mutation occurs, but is of relatively low frequency.

From museum specimens we found non-agouti mutations in three other subspecies: *Thomomys bottae bottae* (MVZ 37486, ♀); *Thomomys bottae pallescens* (MVZ 19194, ♀); and *Thomomys bottae navus* (CAS 4220). Another black individual, *Thomomys* sp. (MVZ 38991) from San Jose, Lower California, May, 1928, was seen. Two other non-agouti individuals, *Thomomys bottae bottae* (MVZ 21088) and *Thomomys bottae navus* (CAS 4219), had, in addition, a dilution factor, considered below.

Another method of explaining the black gophers is by means of extreme extension E^D. This mutation has occurred only in the rabbit and the black rat. This gene is epistatic (or almost so) to the agouti gene and reduces the yellow band on the hair to

such an extent that the animal appears black with possibly an occasional banded hair. It does not seem probable, however, that extreme extension (E^D) is responsible for black gophers. Non-agouti (a) is responsible for the black condition in the mouse, guinea pig and Norway rat, and also causes a black condition in the black rat, and the rabbit. It seems, therefore, more logical to ascribe the black condition in the gopher to non-agouti (a). This indicates that in the gopher there are two forms of the agouti locus, A^w (or A) and a.

PINK-EYED DILUTION

Pink-eyed dilution is a mutation represented in the mouse, Norway rat, and guinea pig but not as yet found in the rabbit or black rat. Californian specimens of pocket gophers clearly exhibit this mutation. There are a *Thomomys bottae bottae* (MVZ 21088, ♀) from San Francisco and a *Thomomys bottae navus* (CAS 4219) from Woodland. Each has the hair all over the body of a dilute sooty black shade, with no evidence of yellow bands on any of the hairs. Unfortunately no record of the eye color was made.

The dilution in these specimens is much more extreme than in the two dilute extended agouti animals described as having c^d dilution. It is also more extreme than the blue dilution, d, known in the mouse, rabbit, and both Norway and black rats. It corresponds more closely to pink-eyed dilution known in the mouse, guinea pig, and Norway rat, and will be classed as such until breeding tests prove it to be otherwise. In these specimens another mutation, non-agouti, a, had occurred which has been described in the preceding discussion. Since in the analysis of the agouti series it has been shown that mutations to non-agouti, which cause self black individuals, are common to several species and subspecies of pocket gophers, and since the non-agouti mutation has been found in both *Thomomys bottae bottae* and *Thomomys bottae navus* from contiguous areas, it is not surprising to find that females MVZ 21088 and CAS 4219 possessed two mutations, p and a.

SELF COLOR AND SPOTTING

The normal wild-type of gopher is not entirely self colored, but shows a small amount of white spotting around the lower jaw and throat, in the cheek pouches, on the legs (especially on the "wrists" and hind feet), and on the terminal portion of the tail. Since these spots of white are very inconspicuous it is quite possible for an observer to overlook them completely in the field, and even in some museum specimens. Moreover, we found that white spotting may not appear in all the areas named above on individuals which show reduced amounts of white. In the normal type of animal the spotting corresponds to Castle's (1919) grade 1 of Dutch spotting as he set it forth in the rabbit.

"DUTCH" SPOTTING

In the collection of the Museum of Vertebrate Zoology we found five individuals, representing four species and subspecies, which had dorsal spotting on the anterior half of the body and which resembled the Dutch spotting of the rabbit discussed by Professor Castle in several publications. We have graded each of the animals which showed aberrant spotting according to Castle's chart of Dutch spotting.

An example of *Thomomys bottae mewa* (MVZ 22482) had the left fore leg completely white, and a narrow transverse band of white ran dorsally on one side almost to the median line; but the ventral surface of the body presented no more white spotting than is found normally. This individual was classified as grade 2. Another individual of this subspecies (MVZ 31794) had much more white on the ventral surface and a solid band of white completely encircling the anterior middle portion of the body. This was classified as intermediate between grades 3 and 4.

One individual of *Thomomys bottae puertae* (MVZ 16641, ♂), had the ventral surface with slightly more white than normal, and a small irregular elongated spot to the right of the mid dorsal axis of the body, a short distance behind the ear. This spot, however, did not connect with the ventral spotting nor with that of the right fore leg. The specimen was classified as grade 2, Dutch.

A specimen of *Thomomys bottae pascalis* (MVZ 28294, ♂), showed the ventral spotting on the lower jaw, throat, and fore feet covering larger areas than usual. On the posterior part of the body there was a spot of appreciable size located medially and anteriorly to the penis. Both hind legs had patches of white larger than ordinary, and a narrow dorsal spot starting at the mid-dorsal line about three centimeters behind the ears extended around the right side of the body to the region of the foot, but did not connect with the spotting on the foot. This also was classified as grade 2.

Of *Thomomys perpallidus* one example (MVZ 16497, ♂) had a large amount of white on the ventral surface both anteriorly and posteriorly. In the anterior ventral region the white on the cheek pouches, lower jaws, throat and legs was connected, and extended ventrally and posteriorly a third of the way back on the right side. On the posterior part of the body the white on the legs connected with a ventral patch of white shaped like the head of an arrow, the point of which ended medianly and ventrally about a third of the way toward the head. The dorsal spotting was composed of one elongated narrow median stripe which extended from the region of the ears to the nose, but did not unite with the ventral spotting of the anterior region. This animal was placed in grade 2.

From our observations it seems that gophers in general possess Dutch spotting of about grade 1, rarely of grade 2, and still more rarely of higher grade.

ENGLISH SPOTTING

One specimen of *Thomomys bottae pascalis* (CAS 415, ♀) apparently shows a type of spotting different from the Dutch. The specimen is white, but there are areas of color around the eyes, on the dorsal side of the body posterior to the ears, and on the mid-dorsal part of the body. This type of spotting is different from any type previously observed in gophers. It corresponds rather closely to English spotting in the rabbit, with which it is provisionally classified until such time as breeding tests may show that it belongs elsewhere. This animal also carries a dilution which was described with the albino allelomorphs.

Specimens of pocket gophers showing white spotting ("partial albinism") or complete albinism are mentioned by Bailey (1915, pp. 20–21); their genetic allocation may be inferred from the analysis of our own material.

CONCLUSIONS

1. A number of aberrantly colored individuals of the pocket gophers representing several different species and subspecies occurring in California were studied and classified as to the possible mutations which had occurred. All were compared with the laboratory mammals, mouse, rats, guinea pig, and rabbit, which have been analyzed genetically. In the absence of breeding tests, this classification can only be considered as tentative but is what we consider the most plausible genetic explanation of the mutations involved.

2. From the evidence at hand it is concluded that three of the albino allelomorphs are present in the wild pocket gopher, namely full color (C), both black and red dilute (c^d), and complete albinism (c).

3. Five red animals indicate that a mutation has occurred in the extension series of allelomorphs. The gene represented in this series is extended (E) found in the normal wild stock and non-extended (e).

4. Black is a condition found sporadically in several different stocks of wild pocket gophers. In addition, one species, *Thomomys niger* of the central Oregon coast, is represented only by black individuals, and another, *Thomomys townsendii townsendii*, locally near Nampa, Idaho, shows a considerable percentage of black individuals. From the evidence it is concluded that this mutation is caused by a change in the agouti locus (A) to non-agouti (a). *Thomomys niger* is inferred to be homozygous for non-agouti.

5. What is interpreted as pink-eyed dilution was found in two non-agouti animals. Eye colors were not given in the field notes. The coat color was a pale sooty black and as a result these animals resembled closely the pink-eyed dilution (p) of the mouse, Norway rat and guinea pig.

6. Two different types of spotting were found. One resembles the Dutch (du) of the rabbit while the other resembles the dominant English (En) spotting of the rabbit.

7. Two different mutations were found in each of six animals. Three possessed non-extended (e) and dilution (c^d); two were non-agouti (a) and exhibited pink-eyed dilution (p); and the sixth had what appeared to be English spotting En with c^d dilution.

8. If students of systematic mammalogy will use the genetic terminology, a more exact record of color aberrations will be provided.

BIBLIOGRAPHY

A complete bibliography concerning the original description of the mutations and their mode of inheritance would be very lengthy; in the literature listed below will be found references to all or practically all of the original papers describing the mutations discussed above and to certain data on mutations in wild rodents.

Bailey, Vernon. 1915. Revision of the pocket gophers of the genus Thomomys. U. S. Department of Agriculture, North American Fauna, no. 39, pp. 1–132, pls. 1–8, figs. 1–10.

Burnett, W. L. 1925. Dichromatism and albinism in Thomomys talpoides clusius. Journ. Mamm., vol. 6, p. 129.

Castle, W. E. 1930a. Genetics and eugenics. Cambridge, Harvard University Press.

———. 1930b. Genetics of domestic rabbits. Cambridge, Harvard University Press.

———. 1934. Genetics of the Dutch coat pattern in rabbits. Journ. Exper. Zool., vol. 68, pp, 377–391, pl. 4.

Castle, W. E., and Paul B. Sawin 1932. Contributions to the genetics of the domestic rabbit. Carnegie Institution of Washington, Pub. no. 427, pp. 1–50.

Dunn, L. C. 1921. Unit character variation in rodents. Journ. Mamm., vol. 2, pp. 125–140.

Hatt, R. T. 1930. Color varieties of Long Island mammals. Journ. Mamm., vol. 11, pp. 322–323.

Haldane, J. B. S. 1927. Comparative genetics of colour in rodents and carnivora. Biological Reviews, vol. 2, pp. 199–212.

Keeler, Clyde E. 1931. The laboratory mouse, its origin, heredity and culture. Cambridge, Harvard University Press.

——— and Virginia Cobb. 1933. Allelomorphism of silver and Siamese coat variations in the domestic cat. Journ. Heredity, vol. 24, pp. 181–184.

Murray, J. H. 1932. Leaden, a recent color mutation in the house mouse. Proc. Sixth Int. Cong. Genetics, vol. 2, pp. 139–140.

Punnett, R. C., and M. S. Pease. 1925. On the pattern of the Dutch rabbit. Journ. Genetics, vol. 15, pp. 375–412, pls. 14–22, fig. 5.

Ridgway, R. 1912. Color standards and color nomenclature. (Washington, D. C., published by author), iii + 1–43 + 1 pp., pls. 1–53.

Divisions of Zoology and Animal Husbandry, College of Agriculture, University of California, Davis, California.

MAMMALIAN LETHAL CHARACTERS

By Sheldon C. Reed

Inherited characters which, when present in the embryonic or immature animal in the duplex condition, are able directly to cause its death are termed "lethal characters." In mammals these characters have been detected in breeding tests in which an expected number of a certain variety of animal failed to materialize. Thus when dominant yellow mice are intercrossed one would expect three yellows to one non-yellow to occur among the progeny, but instead it is observed that there are but two yellow to one non-yellow. Embryological studies show that the homozygous yellow animal perishes early in development.

Lethal characters are of particular interest to those who desire to inbreed the organisms with which they work. In the attempts to inbreed commercially important animals, lethal factors have often been found which, if not eliminated by selection, decrease litter size and vigor, and this may result finally in the loss of the stock.

It is probably safe to assume that of the mutations which have occurred more have been lethal than viable. Muller and Altenburg (1921) have found this to be the case with the mutations produced by x-raying *Drosophila*.

Peculiarly enough there have been no cases of lethals associated with sex observed in mammals other than man, with the possible exception of the work reported by Morgan (1914) and by Little (1920) on mice. In these cases ratios were obtained which indicated an association between sex and a lethal, but more crucial tests were not undertaken.

For a description of the lethal characters[1] for which other references are not given in this paper one should read Mohr's (1929) paper "Letalfactoren bei Haustieren."

The categories of lethal conditions would seem to be as follows, though no sharp lines can be drawn between the classes. Further, the distinction between absolutely lethal and sublethal characters is one separating characters operating in a lethal manner before birth from those taking effect at or after birth.

A. Characters absolutely lethal:

1. Dominant characters having a lethal effect when homozygous.

Among mice, characters belonging in this group are "yellow" and short tail, the "brachyure" of Dobrovolskaia-Zavadskaia (1927).

2. Recessive lethal characters:

A recessive in sheep which stiffens the extremities in lambs in utero and almost invariably results in stillbirths.

[1] Since the above was written, new lethals have been reported; see the following: Crew, F. A. E., and S. K. Kon. 1934. Journ. Genetics, vol. 28. Hallquist, C. 1933. Hereditas, vol. 18. Hutt, F. B. 1934. Journ. Heredity, vol. 25. Hutt, F. B. 1934. Cornell Veterinarian, vol. 24.

B. Characters semi- or sub-lethal:

1. Dominant characters with effects so deleterious that they prove to be lethal in due time.

The anemic offspring of mice having "dominant spotting" do not live to maturity; homozygous "naked" mice are very weak, seldom attaining three-fourths normal size. The second of these characters was described by Lebedinsky and Dauvart (1927) and more extensively by Snell (1931). Wriedt (1925) finds lethal eye abnormalities in a certain type of dominant white dog.

2. The recessive sub-lethal characters are most numerous of all.

Among mice there have been reported "head deformity," "hydrocephalus" (Clark, 1932), "harelip and cleft palate" (Reed and Snell, 1931) and (Cloudman, 1932), and "dwarf" (Snell, 1929); in guinea-pigs, "congenital palsy" and "otocephaly;" in rabbits "hairlessness;" and in dogs, "harelip and cleft

TABLE 1

RATIO	NUMBER IN LITTER	NUMBER OF LITTERS	TOTAL NORMAL YOUNG SURVIVING FOR 1 MONTH	TOTAL NORMAL YOUNG DYING BEFORE 1 MONTH
1:1.1	4 normal + 0–6 harelip Av. litter size, 5.8	67	129	139
1:1.7	3 normal + 0–7 harelip Av. litter size, 5.1	67	75	126
1:2.5	2 normal + 0–7 harelip Av. litter size, 4.3	53	31	75
1:3.1	1 normal + 0–8 harelip Av. litter size, 3.6	32	1	31

palate" (Blades, 1914) and (Wriedt, 1925). In the more valuable domestic mammals there have been found a recessive factor in sheep which causes a variety of abnormalities such as ear defects and cleft palate; in swine a recessive which causes total paralysis of the pelvic limbs, "harelip and cleft palate" (McPhee, Russel and Zeller, 1931); in cattle "achondroplasia congenita" (bulldog calves), "epitheliogenesis imperfecta," "hairless," "amputated" and "short spine;" "atresia coli" occurs in some horses introduced into Japan from America.

C. Indirect lethal effects of characters included under A and B.

This third category of lethal effects has not been pointed out previously. By "indirect lethal effects" is meant the death of normal animals as a result of the death of sibs homozygous for lethal genes. That is, depletion of a litter due to lethal characters indirectly causes the death of healthy litter mates. It is a special case applicable only in certain groups of mammals, such as mice, which produce a large number of young in each litter. Its explanation follows.

Table 1 presents data from a family of over five thousand mice which produced harelip and cleft palate young in ratios which show the character to be hereditary. Practically all harelip young die within twenty-four hours after birth, because of their inability to nurse. Thus we have a depletion of young leaving a varying number of healthy animals in each litter. It was desired that these animals be raised in all cases as they were valuable breeding stock. A remainder of four normal animals in a litter seems to be the optimum number for the greatest chances of survival of each member. In litters in which four normals were left after the death of the harelip sibs, the chances of reaching the age of one month and, incidentally, maturity a few weeks later are about equal. The table shows that if only one normal is left after the death of the harelip animals its chances of survival are very small. Other observations show also that if any members of a depleted litter survive, two or more usually do so. Very seldom do we find that if any of the normals survived, only one did.

One possible reason for this "indirect lethal effect" may be that there must be more than one normal suckling in a litter in order to stimulate proper lactation of the mother.

LITERATURE CITED

BLADES, W. F. 1914. Dental Cosmos, November, 1914, pp. 1–7.
CLARE, F. H. 1932. Proc. Nat. Acad. Sci., vol. 18, pp. 654–656.
CLOUDMAN, A. M. 1932. Proc. Sixth International Congress Genetics, vol. 2, p. 26.
DOBROVOLSKAIA-ZAVADSKAIA, N. 1927. C. R. Soc. Biol. Paris, vol. 97, pp. 1583–1585.
LEBEDINSKY, N. G. and DAUVERT, A. 1927. Biol. Zbl. vol. 47, pp. 748–752.
LITTLE, C. C. 1920. Amer. Nat., vol. 54, pp. 457–460.
MCPHEE, H. C., RUSSEL, E. Z. and JOHN ZELLER. 1931. Journ. Heredity, vol. 22, pp. 393–403.
MOHR, O. L. 1929. Zuchtungskunde, vol. 4, no. 3, pp. 105–125.
MORGAN, T. H. 1914. Amer. Nat. vol. 48, pp. 449–458.
MULLER, H. J. and ALTENBURG, E. 1921. Anat. Record, vol. 20, p. 213.
REED, S. C., and G. D. SNELL. 1931. Anat. Record, vol. 51, pp. 43–50.
SNELL, G. D. 1929. Proc. Nat. Acad. Sci., vol. 15, pp. 733–734.
SNELL, G. D. 1931. Genetics, vol. 16, pp. 42–74.
WRIEDT, C. 1925. Zeit. Tierzucht. u. Zuchtungsbiol., vol. 3, pp. 223–230.

Bussey Institution, Harvard University.

GENERAL NOTES

DASYPTERUS INTERMEDIUS H. ALLEN IN CUBA

Mr. M. Rutten, a member of a geological expedition sent to Cuba by the University of Utrecht, Holland, collected on that island a number of pellets in a cave at San Blas, where a pair of barn owls, *Tyto alba furcata* (Temm.), used to roost.

Among the mammalian remains in these pellets I found, besides a great number of skulls and lower jaws of the introduced European mouse and rat, three skulls of bats, two of which belong to the common *Artibeus jamaicensis* Leach and the third to a species of *Dasypterus*. As I found this genus is "not yet recorded from the West Indies" (Miller, The Families and Genera of Bats, U. S. Nat. Museum Bull. 87, 1907, p. 222), and also because I lacked material for comparison, I sent the skull for further examination to the British Museum, where Mr. Hayman kindly identified it as *Dasypterus intermedius* H. Allen. So far as I know, this is the first record of the genus from Cuba and I thought it therefore worth while to publish this addition to our knowledge of Cuban Chiroptera.—L. F. DE BEAUFORT, *Zoölogical Museum, Amsterdam, Holland.*

RECORDS OF BATS FROM HONDURAS

As there are so few records of bats from Honduras, Central America, Colin Sanborn of the Field Museum of Natural History has suggested that the following notes made by Louis A. Test and the writer be placed on record.

During the summer of 1933, a party of biologists from Purdue University and the University of Louisville spent seven weeks on the north coast of Honduras. Our headquarters were the Lancetilla Experiment Station of the United Fruit Co., near Tela, and the following records, by Louis A. Test and the writer, were all made within a mile of the experiment station grounds. All specimens mentioned have been deposited in the Field Museum and determined by Mr. Colin Sanborn.

Glossophaga soricina leachii (Gray). One night a number of bats were noticed feeding on a stem of ripening bananas that was hanging from a rafter of the open potting shed. With the aid of flashlights and butterfly nets one was captured on August 11 that proved to be a female of this species.

Artibeus jamaicensis palmarum (Allen and Chapman). A male and two females were shot on July 18 as they hung, asleep, from the under side of a Coroza palm leaf along a trail through the jungle.

Eptesicus propinquus (Peters). A male was found hanging from the screen, inside our dining room, on July 19, and another male was collected on July 30.

Molossus sinaloae Allen. On July 3, three males were found in an old tarpaulin in a store shed on the station grounds. W. E. Martin investigated the attic of our bunk house on July 21 and collected about two dozen bats, all of which proved to be of this species; of these, two males and two females were preserved.—FREDERICK H. TEST, *511 Russell Street, West Lafayette, Indiana.*

BROWN BEAR SEEN ON ST. LAWRENCE ISLAND

According to reports from natives of St. Lawrence Island, Alaska, and to all written records, only polar bears have been seen on the island in the past. On August 9, 1933, Roland Snodgrass, member of the Alaska College-Bering Sea Expedition, and his two native guides report having seen a brown bear near Cape Bunnell (West Cape), St. Lawrence Island. The following excerpt from Mr. Snodgrass's note book describes the circumstances:

"We had followed the high cliff from Boxer Bay to Cape Bunnell, where the cliff is broken by a valley known by the Eskimos as Kongkok. The sides were very steep, and

the aneroid showed slightly over 1500 feet as we started to descend. About 200 feet below the rim, Akeya called my attention to a bunch of brown moss about 50 yards away. I handed him the glasses, remarking that it looked like brown bear cubs. He returned them with the announcement that it was a brown bear. He added that it was the first that he had ever seen, and that summer bears were very dangerous. Our firearms consisted of a .22 cal. rifle and a .38 cal. special revolver. Despite the inadequacy of the guns, I decided to attempt to kill the bear as there seemed to be no great risk involved. A strong wind was blowing up the slope. The bear was asleep at the foot of a very steep, narrow ridge of rock which seemed to offer a safe position.

"I told the guides my plan. We started back up the cliff, intending to cross over to the ridge and come down over the bear. When I turned and started across, the boys kept on climbing, taking with them, incidentally, the rifle upon which I relied for accurate shooting. The wind made further communication impossible so I let them go on. I came down the ridge to a position as close as possible to the bear, and took two pictures with the Leica camera. The built-in range finder showed fifty-five feet. Then I shot, aiming for the neck. It was a miss and the wind prevented the noise from waking the animal. The second shot hit the body. The gun failed to fire the next three times I pulled the trigger and the bear started away. I shot ten times as he ran, possibly hitting him twice. Only one shot caused apparent damage, evidently by hitting him in the left shoulder.

"The color was light brown. Judging from other bears, I should guess its weight to be in the neighborhood of a thousand pounds. I do not know the sex, and cannot guess the age."

During the winter, polar bears are numerous on the Island, coming and going with the ice. It is not unusual for polar bears to be stranded when the ice recedes northward in the spring, and to live over the summer months among the snow banks in the higher mountains and along the perpetual snow-banks (Aneegulgit) in the interior. This suggests the probability that the bear was carried from Siberia, which is only 37 miles away at Cape Chibukak, by the ice during the winter or early spring.—Otto William Geist, *Alaska Agricultural College and School of Mines, College, Alaska.*

COATI ADDED TO THE LIST OF UNITED STATES MAMMALS

It is now certain that the coati-mundi (*Nasua narica*, probably subspecies *pallida*) occurs sporadically on the American side of the Mexican border. Evidence at hand may be detailed as follows:

In February, 1924, a coati was killed by J. H. Merritt, now of Sunnyside, Arizona, in the Huachuca Mountains, Cochise County. This specimen, apparently the first to be taken and put on record in Arizona, was made the subject of a report given at the El Paso meeting of the Southwestern Division, American Association for the Advancement of Science, May, 1925, by Dr. Charles T. Vorhies of the University of Arizona.

It is reported by M. E. Musgrave, formerly of the U. S. Biological Survey, now of the Soil Erosion Service, that an adult male coati was taken on May 16, 1924, by James Cooper, 40 miles above Clifton, Greenlee County, Arizona, on the west side of the Blue Range, on the south side of Red Mountain, and more particularly, the south side of Stray Horse Canyon. The animal was in the juniper-pinyon country. The skull and skin are in the Biological Survey collection. Musgrave also reports definite records of three of the animals in the Huachuca Mountains, Cochise County, Arizona, but has mislaid his notes on the details of their occurrence. A coati was reported seen between Mormon Flat and Apache Junction in Maricopa County, and Musgrave has observed tracks and other signs of the animals on the Santa Maria Mountains west of Hillside, Yavapai County, Arizona, though he has not seen any of the animals themselves.

Dr. Vorhies calls my attention to the fact that in the spring of 1926 a coati, taken

alive at Fairbank, Cochise County, Arizona, was kept in a part of the University aviary. It became affected with something resembling scabies and its skin was not worth saving at the time of its death in June or July, 1926. Neither the exact date of its capture nor the name of its captor is now on record. Dr. Vorhies reports also that three or four years ago a badly mounted specimen of coati was on exhibition in a window of the Ronstadt Hardware Company in Tucson. A picture of this specimen and some worthless observations concerning it appeared in one of the local papers. It was taken in the Rincon Mountains, Pima County.

On October 30, 1930, the writer was at de la Osa's Ranch at Lochiel on the Mexican border, Santa Cruz County, Arizona. An ancient coati pelt was hanging in the corner of a shed. No details were forthcoming as to the place of its capture. It may have come from Mexico.

R. F. Wilbur, of the U. S. Bureau of Plant Quarantine, Nogales, Santa Cruz County, Arizona, secured a coati on or about November 14, 1932, at an altitude of 4800 feet in a deep draw between two high points in Sycamore Canyon on the west side of the Patagonia Mountains, Santa Cruz County, very close to the Mexican boundary. The animal was shot 6 feet up the trunk of an oak tree just at the break of day. Mr. Wilbur reports the animal a male, 40 inches in length from the tip of the nose to the tip of the tail. Dung that the animal dropped after it was shot appeared to contain nothing but manzanita berries, or something very much like them. The skull was given to Uhl R. Kuhn of the Bureau of Plant Quarantine, who kindly presented it to the U. S. Biological Survey.

There are two records even more recent than that by Mr. Wilbur. A cowboy working for a rancher named Johnson, whose ranch is located just north of the Santa Rita Experimental Range on the west side of the Santa Rita Mountains, Pima County, shot a coati out of a mesquite tree the last week in April, 1933. The coati was swinging from the tree by its tail and slashing at the dogs with its teeth. One dog was reported injured severely.

A cowboy working for Charles Beach, of Vail, Pima County, Arizona, whose ranch is located on the west side of the Santa Rita Mountains, not far from Mount Fagan, shot a male coati on the north edge of the Coronado National Forest, one mile east of Mr. Beach's ranch house, on September 3, 1933. The skin and skull were presented to the University of Arizona.

Information on the latter two specimens was furnished by Professor A. A. Nichol, University of Arizona.

John C. Gatlin, leader of rodent and predatory animal control, U. S. Biological Survey, Albuquerque, New Mexico, says that coatis occur in southern Hidalgo County, in the southwestern corner of that State. Gatlin, with W. C. Echols, noticed their tracks on the O. K. Camp of the Victoria Land and Cattle Company, about 25 miles south and east of Animas. Coatis also occur, says Gatlin, in the Cloverdale country, and quite generally along the boundary line through Hidalgo County.

Summarizing, it is noted that several actual specimens of the coati have been reported from the southeastern part of Arizona, in Pima, Greenlee, Cochise, and Santa Cruz Counties. Reports based on observations of the animals or their tracks by competent observers extend its probable range to include Hidalgo County in southwestern New Mexico and Maricopa and Yavapai Counties, Arizona. All the records are for the Lower or Upper Sonoran Zones.—WALTER P. TAYLOR, *U. S. Biological Survey, University of Arizona, Tucson, Arizona.*

THE LITTLE SPOTTED SKUNK IN NORTHERN MINNESOTA

A prairie spotted skunk, *Spilogale interrupta* (Rafinesque), was trapped by Melvin Mostol, October 25, 1933, in Section 6, Township of Jadis, Roseau County, Minnesota.

It was trapped in a den from which Mr. Mostol had already taken two striped skunks. It is now in the collection of P. O. Fryklund of Roseau, through whose kindness I have been permitted to examine the skin and publish this note. From the flat skin it was not possible to make accurate measurements, but the specimen is a large one.

The spotted skunk has been reported to be extending its range northward, but all information available at the moment indicates that the present record is possibly the northernmost for the species. In Minnesota it has been known hitherto only from the southern half of the state.—GUSTAV SWANSON, *Department of Zoology, University of Minnesota, Minneapolis.*

PORCUPINE QUILLS IN A FOX SKULL

Recently I received from Mr. George E. Wilcox, of Borodino, N. Y., the skull of a red fox, shot in the Adirondacks in the fall of 1933, which was found to exhibit interesting evidence of a past encounter with a porcupine. This fox was a female of advanced age, which had lost the lower incisors, one lower carnassial, all but one of the upper molars, and all except a small fragment of the upper carnassials. The canines are much flattened from abrasion.

Lodged in the frontal or medial wall of the right orbit are three porcupine quills, all of which had entered the orbit close together at a point just above the lacrimal canal. The barbed tip of the first quill is firmly imbedded in the frontal bone, just inside the rim of the orbit, about five millimeters posterodorsad of the lacrimal canal. The second, lying immediately below the first, has penetrated along the orbital wall to a distance of about 23 millimeters from its point of entry. It is lodged in a groove that has developed in the frontal bone. Part of its middle section is imbedded in the postero-median wall of the orbit, about 7 millimeters below the postorbital process. This quill was least damaged in the process of cleaning the skull, and its exposed barbed portion is practically intact.

The third quill, lying in turn just below the second, also occupies a groove, which, however, becomes shallower posteriorly where only the barbed point of the quill is firmly imbedded in osseous tissue. This quill has penetrated along the orbital wall to a distance of about 27 mm. (measured in a straight line) from its point of entry, so that its point lies in a line with, and 13 mm. above, the optic foramen.

Of interest is the manner in which osseous tissue in places has invaded and filled the interior of the quills, parts of which, as previously remarked, are also firmly imbedded in the frontal bone. As seen under the dissecting microscope the condition reminds one strongly of paraffin infiltration and imbedding.—CHARLES E. JOHNSON, *Roosevelt Wild Life Station, N. Y. State College of Forestry, Syracuse, N. Y.*

WILD COYOTE WITH AN UNDERSHOT JAW

The "bull-dog" type of face is quite common amongst certain kinds of domestic animals and, indeed, is peculiar to some breeds of dogs, as the bull-dog, the pug, and the aboriginal Peruvian pug-nosed dog.[1] The trait is not limited to this family alone; instances of it occur also in the Suidae and the Bovidae, notably the short-faced Berkshire hogs and the niata cattle of South America. Aside from cases where this feature is normal, certain instances of an undershot lower jaw have arisen in races that normally have no sign at all of disharmony in facial proportions, as the bull-dog headed calf mentioned by Warren in 1910. In the wild state, I believe it is rather unusual, though it

---

[1] Allen, G. M., Dogs of the American Aborigines. Bull. Mus. Comp. Zool. at Harvard College, vol. 63, no. 9, pp. 500–502. March, 1920.

evidently may occur as a sport entirely unassociated with domestication. Dönitz[2] mentions a European fox with an undershot lower jaw. While collecting in the Mojave Desert last summer, I shot an interesting specimen of *Canis latrans estor* with a markedly undershot lower jaw. The animal (M. C. Z., no. 29856), taken October 17, 1933, in Antelope Valley, near Lancaster, is a female, adult but rather small, and to all appearances quite normal except for this peculiar formation of the skull. As is the case with certain breeds of dogs, the abnormality is caused entirely by a pronounced shortening of the rostral portion of the skull, due to a failure of the facial bones to develop fully. The braincase seems of normal size but the zygomatic arches are slightly shortened and more spreading laterally than usual. The shortening of the rostrum is accompanied by a depression of the nasals above the second premolars, giving the skull a dish-faced appearance, and by a curious and pronounced inflation of the frontals in the region of the frontal sinuses. The snout is also somewhat broadened, the maxillaries sloping away from the nasal sutures rather less abruptly than is usually the case. Although the teeth are normal in size and number, the premolars in the upper jaw are crowded, throwing the third out of line to such an extent that the left one lies nearly at right angles to the long axis of the jaw and the right one at an angle of about sixty degrees. The shape and size of the lower jaw is quite typical. When the jaws are in place the lower canine closes between the second and third upper incisors, while the upper canine lies parallel with the space between the first and second lower premolars.

A detailed study of this abnormality might be of interest to geneticists. From the evidence at hand it would seem that it may occur as a freak either in wild or domesticated animals of a number of different families, most often in the Canidae.—Barbara Lawrence, *Museum of Comparative Zoology, Cambridge, Mass.*

SOURCE OF SMALL BIRDS EATEN BY THE COYOTE

In the August, 1933, issue of the Journal of Mammalogy there appears an article by Charles C. Sperry, entitled "Autumn Food Habits of Coyotes" in which the following paragraph occurs: "speculation is certain when the examination of a stomach discloses 3 such birds as an ant-eating woodpecker, a bluebird, and a junco with only a few feathers of each. Furthermore, who can explain the presence of 3 tail feathers of a rufous humming-bird, the only bird remains in a coyote stomach otherwise filled with rabbit?"

One who was interested in the vertebrate animals killed by automobiles would seem safe in assuming that the coyotes in question were guests at the often elaborate and diversified animal banquet table—the modern automobile highway.

To one who frequently drives our western plains in the early morning hours, before daylight, when traffic is light, the glowing eyes of some animal on the highway is a common sight; but lacking definite knowledge of which animals' eyes possess the quality of reflecting the glare of the headlights, the two fiery balls may indicate the presence of a wildcat, fox, raccoon, opossum, skunk, or owl. As proof that the coyote is also among those present, at the break of dawn, upon several occasions, the latter animal has been seen sneaking away from the wayside.

It would be upon an exceedingly rare occasion that one would, at night, kill so wary an animal as a coyote by hitting him with an automobile, or even be able to drive near enough to be certain of an identification; but the findings of Mr. Sperry would seem to substantiate the theory that coyotes do feed upon dead animals upon the highways.

---

[2] Dönitz, W., Ueber eine monströse Schädelbildung eines Fuchses aus Schlesien. Sitz.-Ber. Ges. naturf. Freunde Berlin, 1868, pp. 20–21. 1869.

It is my impression that of all our native birds, next to the meadowlarks, the woodpeckers are the most commonly killed by the automobile. One has fallen a victim to my car; and the others enumerated, with the exception of the humming-bird, have had narrow escapes from being destroyed.

To one who has spent six years in more or less intensive study of the problems related to the subject of animals killed by the automobile, it seems quite evident that the student of the stomach contents of our carnivorous mammals and birds has a very perplexing problem in considering whether their findings indicate an animal found dead upon the highway and devoured by one of the flesh eaters, or whether they represent a living animal caught by one of the predators.—WILLIAM BEBB, *Elkhorn, Wisconsin.*

COUGAR SURPRISED AT WELL-STOCKED LARDER

Though the incident I will relate here occurred many years ago, observations of the natural lives of cougars are so few that no opportunity to add to the recorded natural history of this animal should be neglected.

One hot July afternoon in 1919 found us fighting our way down through Smith Creek Canyon where it winds a tortuous way around the south base of Mt. Hamilton, California. Pungent scent of pennyroyal in the still, heavy air stifled us and seemed fairly to anesthetize our senses. Later we wondered if this heavily laden, still air failed to carry the human scent to the cougar. Then, too, the noise of the water may have muffled the sound of our footsteps. Bends in the ravine were so sharp and the banks so precipitous that we chose to go right down the bed of the creek, jumping from boulder to boulder and wading the shallows.

We rounded a point of rock and were instantly thrown into a frozen surprise by the sudden rush of a very large animal up from the waterside. For a few seconds the cougar was flattened close to earth, clutching at the loose soil, its long tail thrashing pendulum fashion as it struggled for footholds up the nearly vertical cliff. Then it disappeared in the protecting brush.

A lone live oak hugged the cliff. It was growing in a tiny cove in the outside curve of the creek, and this cove was deeply carpeted with oak leaves. When we first saw the cougar it was under this tree A search of the ground revealed nothing, so that we concluded that the heat of the day had brought the predator to the stream for refreshment. We started to walk away when my boot came in contact with a small hoof protruding like a mushroom from the dead leaf bed. This belonged to a deer fawn, and not three feet away we uncovered another fawn that had been completely buried from sight.

The fawns could not have been twins since one was at least two weeks older than the other. We thought that the small fawn could not have been dead many hours, since it felt somewhat warm to the touch and the muscles had not stiffened. Both fawns bore a bloody patch, about two inches in diameter, back of the right eye and just below the base of the ear. The bellies of both were slit open, the entrails lying clear outside of the body cavity but inclosed in the peritoneal sac, which was not broken in either case. The rear right flank of the larger, older fawn was partially eaten, exposing the bones.

When we returned to this spot three days later, nearly all of the fleshy parts were gone from both fawns, leaving the heads, the legs below the astragalar joints, and the viscera still uneaten. Oddly enough, the fawns both showed leg bones broken and joints bent in a similar manner as though a butcher had especially prepared them for roasting and serving whole. This was evidently not the work of coyotes, and since these animals are abundant in this region we concluded that the cougar had remained in the vicinity, guarding its kill for its own consumption, against all carrion feeders.—GEORGE M. WRIGHT, *Wildlife Division, U. S. National Park Service, Berkeley, California.*

RED SQUIRREL KILLING YOUNG COTTONTAIL AND YOUNG GRAY SQUIRREL

On April 30, 1924, at Ithaca, New York, Raymond Patno brought me a young cottontail (*Sylvilagus floridanus mearnsi*) about nine days old. He had seen a red squirrel (*Sciurus hudsonicus loquax*) at 6:30 a.m., attempting to climb a tree with the young rabbit in its mouth. When approached, the squirrel dropped the small rabbit and ran up the tree. The brain and one ear of the cottontail had been consumed, yet the animal was still warm and limp when recovered. The circumstances clearly point to the squirrel as the killer of this nestling rabbit.

At Ithaca, on April 15, 1925, Dr. Thomas Smyth saw a red squirrel carrying a young gray squirrel (*Sciurus carolinensis leucotis*). The young gray was the size of a chipmunk. By bombarding it with stones, Smyth induced the red squirrel to drop its prey, which was found to be dead having been bitten through the back and neck.—W. J. Hamilton, Jr., *Cornell University, Ithaca, New York.*

NOTES ON AN APPARENT DEFENSE ATTITUDE IN GROUND SQUIRRELS

While approaching trapped live ground squirrels, *Citellus beringensis* (Merriam), at Point Hope, northwestern Alaska, and *Citellus plesius ablusus* (Osgood) at Unalaska, eastern Aleutian Islands, in the fall of 1931, I noted that certain individuals directed the rear parts toward the observer, and, at the same time, protruded three anal papillae. No odor could be detected at the time of capture. In these instances the squirrels assumed a half-crouched posture, raised the fur so that it stood on end, exposed the teeth by drawing back the lips, and produced divers vocal notes of a threatening tone—altogether suggesting a state of extreme rage which might well cause an opponent to regard the squirrel as a formidable adversary.

Examination of freshly killed animals showed that three anal papillae were present in members of each sex. One papilla was dorsal in position, and the other two were lateral. Pressure on the sides of each papilla did not expel any liquid, though once a minute quantity of semi-solid material was extruded.

From Mr. Eric Hill I learn that he has observed somewhat similar postures in *Citellus richardsoni* at times when he was handling refractory individuals in captivity.

It may be that these glands function as scent organs, which are useful, or necessary, during breeding activities, and not as organs useful in defense. In that case, these specimens, trapped in the autumn after the breeding season had passed, might not be expected to have actively functioning scent glands.—Raymond M. Gilmore, *Museum of Vertebrate Zoology, University of California, Berkeley, California.*

AIR CIRCULATION IN THE BEAVER HUT

The beaver hut, seen from the outside, appears to be so tight that it seems astonishing that the occupants can get sufficient air. Especially in the winter, when the lodge is covered with snow and ice, one would not think it possible that the animals could live in these apparently airtight dwellings. In the winter of 1927–28 I observed a good example of how the air circulation takes place. Within half an hour's walk of my home is situated a small lake—Kroktjonn—connected with a greater lake Vikvatn,[1] where beavers for several years have been found. In the outlet of Kroktjonn the beavers constructed a dam, and, in the autumn of 1927, a great lodge also. When winter came the snow fell to more than the usual depth. When now and then I passed the hut on the ice I often went up to look at it. In the outlet of the lake the water was still open and here I noticed the footmarks of the beavers on the thin ice. Twigs and small trunks were dragged to the open water, where the beavers sat on the edge of the ice and took their meals.

---

[1] See my article "The Beaver in Norway," Journ. Mamm., vol. 9, no. 2, May 1928, pp. 99–104.

A fox had his usual track over the lodge and I could see that he had examined the lodge. Meanwhile more snow fell and the hut was more and more hidden under the white blanket. Several times I noted that the fox had gone up to the top of the dome and had obviously sat there for a while. When I had seen this several times I went up to the top of the lodge to determine what the reason could be. Close by where the fox had sat was a hole in the snow about half a foot in diameter and with thin ice around the edge. By close examination I found that the hole widened downward and ended on the roof of the lodge. At the bottom the hole was at least two feet in diameter and the walls of the hole were hard as ice. Up from the hole or "chimney" rose a warm steam, and the twigs and mud on the roof of the hut felt warm and damp to my hand. This was what the fox had discovered; he had caught the smell of the beavers through this chimney which served as an air circulator through the snow. In the roof of the lodge was a small hole and as the warm air steadily melted the snow and little by little the chimney was formed.—Sigvald Salvesen, *Aamli, Norway.*

MELANISM IN AN ALASKAN VOLE

In the summer of 1933 a black specimen of a vole from St. Lawrence Island was sent to me by Mr. O. W. Geist, who obtained it during the course of his archeological work on the island under the direction of Dr. C. E. Bunnell, president of the Alaska Agricultural College and School of Mines. According to the label, this mouse, a female, had been caught by an Eskimo on October 23, 1932, on the tundra southwest of Ivectuk, near the river.

Careful comparison with specimens of *Microtus innuitus innuitus*, which were included in Mr. Geist's collection, disclosed no significant cranial differences. The black specimen is rather small and the cranial measurements fall within the lower range of measurements for a series of normal *innuitus*; the skull shows none of the ruggedness and rugosities of those of old individuals of that species. The enamel pattern shows no unusual character. There can be no doubt that this is a dark specimen of *Microtus innuitus innuitus*. The pelage is long and silky, and the upperparts are a pure glossy black. The underparts are only slightly duller and paler, with a barely discernible suggestion of brownish. The aspect of the specimen as a whole is black over all, lacking the well-defined bicolored pattern of the normal pelage. The hairs of the feet are not so dark as those of the back but are much darker than in normal specimens. The tail is black, somewhat paler underneath, but here again the sharply defined bicolored pattern is not apparent. There is a narrow margin of white on the lips. It should be noted that heavy pigmentation has encroached on all parts of the body, except the edges of the lips, which remain white as in normal specimens.

This is a striking case of melanism. Black mice, although said to be scarce, are known to the Eskimos, who associate them with specific localities on the island. According to the data supplied me by Mr. Geist and his blue-print map of the island, there are at least five localities on St. Lawrence Island where these mice are found. These are all on the coast of the middle portion of the island, two on the south coast, one of these opposite the west end of the Kookoolgit Mountains and the other opposite the middle portion of the range. On the north coast are three localities, one near the west end of the Kookoolgit Mountains, one some distance west of Kukulik, and another near Ivectuk, where the specimen here described was secured. As shown on Mr. Geist's blue print, these localities are in an irregular circle, 10 to 15 miles in diameter.

The data indicate that there is a distinct melanistic tendency in *Microtus innuitus innuitus*, localized in the middle portion of St. Lawrence Island. Similar instances among other mammals are furnished by *Citellus osgoodi*, so many of which are melanistic, and by *Marmota flaviventris nosophora*, of Jackson Hole, Wyoming, where melanism is also somewhat localized.—Olaus J. Murie, *Jackson, Wyoming.*

RECENT LITERATURE

CARPENTER, C. R. A FIELD STUDY OF THE BEHAVIOR AND SOCIAL RELATIONS OF THE HOWLING MONKEYS. Comparative Psychology Monographs, vol. 10, no. 2, pp. 4–168, figs. 3, pls. 16. May, 1934. Johns Hopkins Press, Baltimore, Md. Price, $2.25.

This is a publication that is a challenge to all mammalogists who are interested in reporting observations on life histories. It is a thorough piece of work, sound, instructive, and readable. While the vocabulary employed is not the usual one found in papers written by mammalogists the differences are not as marked as the title might indicate. Mammalogists will be interested in the frequent use of statistical methods.

After defining the purpose of the study, Carpenter gives a brief account of the regions in which he worked, and then takes up the classification and description of the subspecies studied. In this classification he follows the recent work of Lawrence. A review of the literature on the natural history of the howling monkeys, from Dampier's early report to the present, ends the introductory portion of the report.

The body of the paper is given over to a very thorough exposition of every phase of the life history of a most interesting primate that it was possible for a keen and enthusiastic observer to note. These phases run from descriptions of locomotion and feeding through territoriality and nomadism to the relations of howlers to other animals of the same environment. Organization of the group, its integration, social relations between the various members composing a "clan" and between "clans," group coördination, and control, are all well treated in a very clear and satisfactory manner. As an indication of the fullness of treatment one example will illustrate: the section on feeding activity contains some nine pages, including an annotated list of food plants almost four pages in length.

One of the notable achievements is the determination of the number of howlers living on Barro Colorado Island, not only as to total numbers but also as to sex and the percentages of young animals. Thus he found, in 1932, 398 ± 50 animals living in 23 groups, while a year later he found 489 ± 25 living in 28 groups. Having been in the field with Carpenter, the writer believes these figures to be more accurate than Carpenter claims them to be. The method used in arriving at these figures is described and the ranges of the groups recorded upon maps, so these data are available to anyone who would follow the change in the island population. Carpenter suggests that possibly 2000 howlers could be supported by the 3840 acres of Barro Colorado Island.

Altogether, this paper is a most satisfactory study, making the life history of *Alouatta palliata aequatorialis* known better than that of any other Neotropical mammal.

The monograph is well organized and indexed; there are many excellent photographs and a bibliography of 74 titles.—ROBERT K. ENDERS.

(ANONYMOUS.) La plaga de las tuzas y manera de combatirlas Estados Unidos Mexicanos Secret. Agric. y Fomento Ofic. Fed. Defensa Agric. Bol. Divulg., vol. 9, pp. 1–16, figs. 6. 1928. (Pocket gophers (*Geomys*) and methods of control.)

———. Predatory mammals and game birds. Nature, London, vol. 132, no. 3344, p. 866. December 2, 1933.

———. The European wolf. Nature, London, vol. 132, no. 3345, p. 906. December 9, 1933.

———. Tule elk transferred from Yosemite. Parks and Recreation, vol. 17 no. 4, pp. 148–149. December, 1933. (Moved to Owens Valley, Calif.)

ANTHONY, H. E. Glimpses into the hall of ocean life. Natural History, New York, vol. 33, no. 4, pp. 365–380, figs. July-August, 1933.

ANTHONY, R. A propos de la nomenclature générique et de la classification des Primates dans la monographie de D. G. Elliot. Bull. Soc. Zool. France, vol. 58, nos. 3–4, pp. 242–247. September, 1933.

ARTIGAS, PAULO. Sobre o parasitismo do *Saimiris sciureus* por um *Gongilonema* (*G. saimirisi* n. sp.) e as possibilidades de infestação humana. Rev. Soc. Paulista Med. Vet., vol. 3, nos. 3–4, pp. 83–88, figs. 6. May–August, 1933.

ARTIGAS, PAULO, and GENESIO PACHECO. *Longistriata maldonadoi* n. sp. (Nematoda) Trichostrongilidae parasite of *Myocaster coypus*. Rev. Biol. e Hyg., vol. 4, no. 2, pp. 68–71, figs. 7. August, 1933.

BARCLAY, EDGAR N. Notes on the roe deer. Ann. and Mag. Nat. Hist., London, ser. 10, vol. 12, no. 67, pp. 66–80. July, 1933. (Discussion of variation with respect to coloration, length and texture of coat, size, and antlers.)

B[ARNES], R. M. An albino buffalo. Oölogist, vol. 50, no. 10, pp. 138–139. October, 1933. (On National Bison Range near Moiese, Montana.)

BEAL, R. P. Giant sequoia houses chipmunk family. Yosemite Nature Notes, vol. 12, no. 8, p. 77. August, 1933.

BEATTY, M. E. Ground squirrel snares robin. Yosemite Nature Notes, vol. 12, no. 8, p. 81. August, 1933.

———. Mountain sheep found in Lyell Glacier. Yosemite Nature Notes, vol. 12, no. 12, pp. 110–112, fig. 1. December, 1933. (A mummified carcass of the mountain sheep, *Ovis canadensis sierrae*, thought to have been extinct in the Yosemite region for at least 50 years, represents the first complete skeleton from this region.)

BEAUX, OSCAR DE. Lo Stambecco dell'Eritrea. Annali Mus. Civ. Stor. Nat. Genova, vol. 56, pp. 384–394, fig. March 9, 1934. (*Capra nubiana*.)

BLAIR, W. REID. The medical care of animals in the zoo. Scientific Monthly, vol. 35, no. 5, pp. 454–457. November, 1932.

BODE, FRANCIS D. Anchitheriine horses from the Merychippus zone of the North Coalinga district, California. Contrib. to Palaeont., Carnegie Inst. Washington, Publ. 440, pp. 43–58, pls. 5. November 15, 1933.

BOYNTON, W. H., and GLADYS M. WOODS. Deer as carriers of Anaplasmosis. Science, n. s., vol. 78, no. 2033, pp. 559–560. December 15, 1933.

BRANDER, A. A. DUNBAR. The colour of 'white bison' (*Bibos gaurus*). Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 985–986. December 15, 1933.

BUCKHURST, A. S. A seal in the Thames. Nature, London, vol. 132, no. 3344, p. 860. December 2, 1933.

BURT, WILLIAM HENRY. A new rice rat (Oryzomys) from Sonora, Mexico. Proc. Biol. Soc. Washington, vol. 47, pp. 107–108. June 13, 1934. (New: *Oryzomys couesi lambi*.)

BURTON, R. W. A visit to the Whipsnade Zoological Park. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 878–883. December 15, 1933.

CHALMERS, PATRICK R. A quarry of the forests. Hunting the elk in Sweden. Field, London, vol. 162, no. 4211, p. 646, figs. September 9, 1933.

———. Asset and nuisance. Some reflections on the rabbit. Field, London, vol. 162, no. 4214, p. 826, figs. September 30, 1933.

CHAMPION, F. W. The jungle in sunlight and shadow. Part 1.—What is the use of leopards? Field, London, vol. 162, no. 4205, pp. 286–288, figs. July 29, 1933. (Photographs of leopard and panther.)

———. The jungle in sunlight and shadow. Part 2.—About Bhaloo the bear: and some new views on protective colouring. Field, London, vol. 162, no. 4206, pp. 358–359, figs. August 5, 1933. (Photographs of sloth bear and cheetal.)

CHAMPION, F. W. The jungle in sunlight and shadow. Part 3.—Fishing cats and ratels. Field, London, vol. 162, no. 4207, pp. 428–429, figs. August 12, 1933.

———. The jungle in sunlight and shadow. Part 4.—Photographing swamp deer and a riddle of the forest. Field, London, vol. 162, no. 4208, pp. 482–483, figs. August 19, 1933.

———. The jungle in sunlight and shadow, Part 5.—The alleged cruelty of tigers. Field, London, vol. 162, no. 4209, pp. 536–537, figs. August 26, 1933.

CHAPPELLIER, A. La lutte contre le Rat musqué (*Fiber zibethicus*). Institut des Recherches Agronomiques, Paris, pp. 72, figs. 25, pls. 4. 1933.

CHASEN, F. N. Notes on the Fauna of Christmas Island, Indian Ocean. Bull. Raffles Mus., Singapore, Straits Settlements, no. 8, pp. 51–54. December, 1933.

———. On the forms of *Rattus rattus* occurring on the mainland of the Malay Peninsula. Bull. Raffles Mus., Singapore, Straits Settlements, no. 8, pp. 5–24. December, 1933.

CHAWORTH-MUSTERS, J. L. On the type-locality and synonymy of *Ochotona pusilla* (Pallas). Ann. and Mag. Nat. Hist., London, ser. 10, vol. 12, no. 67, p. 137. July, 1933. (Neighborhood of Samara.)

——— A note on the synonymy of *Cricetulus barabensis* Pallas. Ann. and Mag. Nat. Hist., London, ser. 10, vol. 12, no. 68, pp. 221–223. August, 1933.

CLOWES, E. F. Stoat feeding young on rock pipits. Irish Naturalists' Journ., vol. 4, no. 11, pp. 217–218. September, 1933. (*Mustela hibernica.*)

COBB, W. MONTAGUE. The dentition of the walrus (*Odobenus obesus*). Proc. Zool. Soc. London for 1933, pt. 3, pp. 645–668, figs. 8, pls. 6. September 20, 1933.

COCKERELL, T. D. A. An apparently extinct *Euglandina* from Texas. Proc. Colorado Mus. Nat. Hist., vol. 9, no. 5, pp. 52–53. December 16, 1930. (Bones of *Desmodus rotundus murinus*, *Macrotus californicus*, *Equus*, *Bison*, and *Ovis* found in limestone crevice, 350 feet below present surface level, near Terlingua, about 90 miles south of Alpine, Texas.)

——— Expeditions. Science, vol. 78, no. 2026, pp. 384–385. October 27, 1933.

COLE, H. A. The mammary gland of the mouse, during the oestrous cycle, pregnancy, and lactation. Proc. Roy. Soc. London, ser. B., vol. 114, no. B 787, pp. 136–161, figs. 28, pls. 9–14. December 1, 1933.

COLLINS, R. LEE. Mylodont (ground sloth) dermal ossicles from Colombia, South America. Journ. Washington Acad. Sci., vol. 23, no. 9, pp. 426–429, fig. 1. September 15, 1933.

COOK, THOMAS W. The human chin and human tooth change. Internat. Journ. Orthodontia and Dentistry for Children, St. Louis, vol. 19, no. 7, pp. 730–734, fig. 1. July, 1933.

COOLIDGE, HAROLD J., JR. *Pan paniscus*. Pigmy chimpanzee from south of the Congo River. Amer. Journ. Phys. Anthrop., vol. 18, no. 1, pp. 1–57, figs. 4, pls. 2. July–September, 1933.

CRAFT, W. A. The sex ratio in the mule. Record of Proc., Ann. Meeting 1932, Amer. Soc. Anim. Protection, pp. 2–3. (Paper no. 149, Dept. Genetics, Wisconsin Agric. Exper. Sta., pp. 283–285.)

CROIX, PAUL MAGNE DE LA. Des retours de l'évolution et de la relativité des théories. Anales Soc. Científica Argentina, vol. 116, no. 5, pp. 225–239, figs. 7. November, 1933.

D. ——— Capturing a Nepal rhino. Field, London, vol. 162, no. 4213, pp. 769–770, figs. September 23, 1933.

DAVIS, D. H. S. Rhythmic activity in the short-tailed vole, *Microtus*. Journ. Animal Ecology, vol. 2, no. 2, pp. 232–238. November, 1933.

DICE, LEE R. The inheritance of dichromatism in the deer-mouse, *Peromyscus maniculatus blandus*. Amer. Nat., vol. 67, no. 713, pp. 571–574. November–December, 1933.

——— Variation in *Peromyscus maniculatus rufinus* from Colorado and New Mexico. Occas. Papers Mus. Zool., Univ. Michigan, no. 271, pp. 32. July 1, 1933.

DIETRICH, W. O. Ein ungewöhnliches Stosszahngeschiebe. Zeitschr. Geschiebeforsch., vol. 9, no. 4, pp. 199–204, figs. 3. October 10, 1933. (Tusk probably that of young mammoth.)

DITMARS, RAYMOND L. The smaller carnivores. Bull. New York Zool. Soc., vol. 36, no. 5, pp. 119–140, figs. September–October, 1933.

——— Development of the silky marmoset. Bull. New York Zool. Soc., vol. 36, no. 6, pp. 175–176. November–December, 1933.

DOLLMAN, GUY. The pigmy anteater. Nat. Hist. Mag. (British Mus.), London, vol. 4, no. 27, pp. 104–105, 1 fig. July, 1933.

——— Dugongs from Mafia Island and a manatee from Nigeria. Nat. Hist. Mag. (British Mus.), London, vol. 4, no. 28, pp. 117–125, figs. 7. October, 1933.

DRAPEAU, ELIZABETH EAST. An anatomical study of the furless condition in rabbits. Journ. Morphol., vol. 54, no. 2, pp. 365–385, pls. 1–3. March, 1933.

DROUGHT, J. B. Foxes and pheasants. Field, London, vol. 162, no. 4201, p. 47, figs. July 1, 1933.

EDSON, J. M. A visitation of weasels. Murrelet, vol. 14, no. 3, pp. 76–77. September, 1933.

EISENTRAUT, M. Biologische notizen über heimische Fledermäuse, insbesondere aus der umgebung Berlins. Sitz.-Ber. Gesell. Naturforschender Freunde Berlin, 1932, pt. 2, pp. 193–206. October 15, 1932.

ELDER, J. H., and H. W. NISSEN. Delayed alternation in raccoons. Journ. Comp. Psych., vol. 16, no. 1, pp. 117–135. August, 1933.

EPSTEIN, H. Descent and origin of the Afrikander cattle. Journ. Heredity, vol. 24, no. 12, pp. 449–462, figs. December, 1933.

EWING, H. E. Some peculiar relationships between ectoparasites and their hosts. Amer. Nat., vol. 67, no. 711, pp. 365–373. July–August, 1933.

FIGGINS, J. D. The generic status of ? *Caenopus premitis*. Proc. Colorado Mus. Nat. Hist., vol. 13, no. 1, p. 1. June 23, 1934. (New: *Procaenopus*, for ? *Caenopus premitis* Cook and Gregory, 1928.)

FINLAYSAN, H. H. *Mastacomys fuscus* [!] (Muridae) still extant. Nature, London, vol. 132, no. 3342, p. 786. November 18, 1933. (Lives in high mountains of Tasmania.)

FLAHAUT, MARTHA REEKIE. Hoary bat taken in Seattle, Washington. Murrelet, vol. 14, no. 3, p. 77. September, 1933.

FLEAY, DAVID. The rare dasyures (native cats). Victorian Naturalist, vol. 49, no. 3, pp. 63–68, figs. 3, pls. 3. July, 1932. (*Dasyurus viverrinus*.)

——— The greater flying phalanger. Victorian Naturalist, vol. 50, no. 6, pp. 135–142, figs. 2, pls. 5. October, 1933. (*Petauroides volans*.)

FRANK, A. S. Seasonal colour change of stoat. North Western Nat., Scotland, vol. 8, no. 3, pp. 242–243. September, 1933.

FRECHKOP, SERGE. Notes sur les Mammifères. XV. Les relations entre les molaires antagonistes chez les Mammifères végétariens. Bull. Mus. Roy. d'Hist. Nat. Belgique, Bruxelles, vol. 9, no. 41, pp. 1–35, figs. 19. December, 1933.

FULTON, J. F., and J. G. DUSSER DE BARENNE. The representation of the tail in the motor cortex of primates, with special reference to spider monkeys. Journ. Cell. and Comp. Physiol., vol. 2, no. 4, pp. 399–426, figs. 12. February 20, 1933.

GARROD, A. E. Recent excavations in the Near East. Nature, London, vol. 132, no. 3348, pp. 1010–1011. December 30, 1933. (Report of paper read by Miss Garrod before Sect. H. of B. A. at Leicester in regard to *Palaeanthropus palestinus* and other prehistoric mammals.)

GOODWIN, G. G. Mammals collected in the maritime province of Siberia by the Morden-Graves North Asiatic Expedition, with the description of a new hare from the Amur River. Amer. Mus. Novitates no. 681, pp. 18. December 30, 1933. (New: *Lepus timidus mordeni*.)

GRANGER, WALTER, and WILLIAM K. GREGORY. An apparently new family of Amblypod mammals from Mongolia. Amer. Mus. Novitates no. 720, pp. 1–8, figs. 4. May 4, 1934. (New: *Pantolambdodontidae*, *Pantolambdodon*, *P. inermis*, *P. fortis*.)

GREEN, C. V. Inheritance of foot length in a mouse species cross. Journ. Heredity, vol. 24, no. 11, pp. 440–442, figs. 8. November, 1933.

GREEN, C. V., and ELIZABETH FEKETE. Differential growth in the mouse. Journ. Exper. Zool., vol. 66, no. 3, pp. 351–370. November 5, 1933.

GREEN, H. U. The wapiti of the Riding Mountain, Manitoba. An ecological study and commentary. Canadian Field-Nat., vol. 47, no. 6, pp. 105–111, September, 1933; no. 7, pp. 122–132, October, 1933; no. 8, pp. 150–157, November, 1933; no. 9, pp. 172–174, December, 1933. Illus.

GREEN, R. G., M. S. KATTER, J. E. SHILLINGER, and K. B. HANSON. Epizootic fox encephalitis. IV. The intranuclear inclusions. Amer. Journ. Hygiene, vol. 18, no. 2, pp. 462–481, figs. 13. September, 1933.

GREGORY, PAUL WALLACE, and HAROLD GOSS. Glutathione concentration and hereditary body size. II. Glutathione concentration in non-nursed young of six populations of rabbits differing in genetic constitution for adult size. III. The backcross to the large parent race. Journ. Exper. Zool., vol. 66, no. 1, pp. 155–173, August 5, 1933; no.3, pp. 335–349, November 5, 1933.

GREGORY, WILLIAM K. Nature's wild dog show. Bull. New York Zool. Soc., vol. 36, no. 4, pp. 83–96, figs. July–August, 1933.

GRUBBS, SAMUEL B. Rat proofing on land and sea. Journ. Pan-Pacific Res. Inst., Honolulu, vol. 8, no. 3, pp. 11–13, pls. 3. July–September, 1933.

GUBLER, ROBERT. Die Mundbodenorgane des Wildschweines. Anat. Anz., vol. 77, nos. 8–10, pp. 129–168, figs. 8. December 20, 1933.

HALL, E. RAYMOND, and DONALD M. HATFIELD. A new race of chipmunk from the Great Basin of Western United States. Univ. Calif. Publ. in Zool., vol. 40, no. 6, pp. 321–326, fig. 1. February 2, 1934. (New: *Eutamias minimus scrutator*.)

HAMILTON, W. J., JR. The weasels of New York. Their natural history and economic status. Amer. Midland Nat., vol. 14, no. 4, pp. 289–344, figs. 3, pls. 6–9. July, 1933.

HAMLETT, G. W. D. Polyembryony of the armadillo: genetic or physiological? Quart. Rev. Biol., Baltimore, vol. 8, no. 3, pp. 348–358. September, 1933.

HARDY, ERIC. The disappearing harvest-mouse. Field, London, vol. 162, no. 4201, p. 45. July 1, 1933.

HARMAN, MARY T., and MARJORIE PRICKETT DOBROVOLNY. The development of the external form of the guinea-pig (*Cavia cobaya*) between the ages of 21 days and 35 days of gestation. Journ. Morphol., vol. 54, no. 3, pp. 493–515, pls. 2. June, 1933.

HARROWER, GORDON. *Nycticebus malaianus*. A dissection of the abdomino-pelvic viscera. Spolia Zeylanica, Ceylon Journ. Sci., sec. B. vol., 18, pt. 1, pp. 73–87, figs. 9, pl. 6. December 22, 1933.

HAWLEY, JAMES H., and NORMAN L. MUNN. Visual discrimination of movement by white rats. Journ. Comp. Psych., vol. 16, no. 1, pp. 137–141. August, 1933.

HEIM DE BALSAC, H. Remarques sur la note de M. Rode 'A propos des Noctules de France.' Bull. Mus. Nat. Hist. Nat., Paris, vol. 4, no. 5, pp. 484–486. 1932

——— Un chéiroptère nouveaux pour la faune française: *Nyctalus maximus* (Fatio), représenté dans les collections du Museum. Bull Mus. Nat. Hist. Nat., Paris, vol. 4, no. 2, pp. 162–164. February, 1932.

——— and MAX BÉGOUEN. Faits nouveaux concernant les damans de l'Ahaggar. Bull. Mus. Nat. Hist. Nat., Paris, vol. 4, no. 5, pp. 478–483. 1932.

HEISSEL, WERNER. Fund eines Mammutzahns bei Kufstein (Tirol). Zeitsch Gletscherkunde, vol. 21, nos. 1–3, pp. 196–197. July, 1933.

HELBING, H. Ein Orycteropus-Fund aus dem Unteren Pliocaen des Roussillon. Eclogae Geol. Helvetiae, vol. 26, no. 2, pp. 256–267, figs. 4. December, 1933. (New: *Orycteropus depereti.*)

HINGSTON, R. W. G. Psychological weapons in animal fight. Character and Personality, Durham, N. C., vol. 2, no. 1, pp. 3–21, figs. 6. September, 1933.

HOWELL, J. M. Disappearance of polecats. Field, London, vol. 162, no. 4202, p. 115. July 8, 1933.

HURST, G. S. Jackal hybrids. Field, London, vol. 162, no. 4206, p. 381, figs. August 5, 1933.

HUTCHINSON, WALLACE. The battle of Matilija Canyon [Santa Barbara Forest, Calif.]. Amer. Forests, vol. 39, no. 1, pp. 3–5, 26. January, 1933. (Effect of forest fires on wild life.)

IREDALE, TOM, and E. LE G. TROUGHTON. The correct generic names for the grampus or killer whale and the so-called grampus or Risso's dolphin. Records Australian Mus., vol. 19, no. 1, pp. 28–36, pl. 10. August 2, 1933. (New: *Grampidelphis* new name for *Grampus* Gray, 1846, nec Gray, 1828; *G. exilis*, *G. kuzira.*)

ISSUPOV, V. La plastéinisation du tissue musculaire du mammouth. Comptes Rendus Acad. Sci. U. R. S. S., 1933 A, no. 7, pp. 99–103. (In Russian, with French summary.)

JACKSON, H. H. T., and H. E. WARFEL. Notes on the occurrence of mammals in the regions adjacent to the salt plains of northwestern Oklahoma. Biol. Surv., Publ. Univ. Oklahoma, Norman, vol. 5, nos. 1–4, pp. 65–72, figs. 42–49. (December 30, 1933) February 28, 1934.

JACOBSON, EDWARD. De neusaap, *Nasalis larvatus* Geoffr. De Tropische Natuur., Buitenzorg, vol. 22, no. 9, p. 164. September, 1933. (Photograph of freshly killed adult male.)

——— Waarnemingen betreffende gibbons en andere dieren. De Tropische Natuur., Buitenzorg, vol. 22, no. 9, pp. 161–164. September, 1933.

JEFFREYS, H. Elephants and rhinos. Field, London, vol. 162, no. 4206, p. 379. August 5, 1933.

JOHNSON, GEORGE E., E. L. GANN, M. A. FOSTER, and R. M. COCO. The effect of daily heteropituitary implants into adult but sexually inactive male ground squirrels. Endocrinology, vol. 18, no. 1, pp. 86–96, figs. 9. January–February, 1934.

KRAGLIEVICH, LUCAS. La antigüedad plíocena de las faunas de Monte Hermoso y Chapadmalal, deducídas de su comparación con las que le precedíeron y sucedíeron. With foreword by G. F. C., s. j., and complete bibliography of Kraglievich. El Siglo Ilustrado, Montevideo, pp. 1–136, fig. 1, pl. 1. 1934. (New: *Nuñezia*, *Nuñezia carloameghinoi*, *Glossotheridium* for *Eumylodon chapadmalensis* Ameghino, *Paleuphractus* for *Dasypus argentinus* Moreno &

Mercerat, *Eutatopsis* for *Eutatus inornatus* Rovereto, *Diaphoromys artusii*, *Pseudoplataeomys* for *Plataeomys scindens* Ameghino, *Pseudoplataeomys formosus* new name for *Plataeomys scindens* Ameghino, 1881, *Palaeocavia paranense*. Nomen nudum: *Triisodontomys*. Not new in this publication: *Berroia*, 1932; *Prolestodon*, 1932; *Pseudosigmomys*, 1931; *Telodontomys*, 1931.)

LeCompte, E. Lee, and Frank R. Smith. Annual report of scientific investigation of the muskrat industry of Maryland. Maryland Conservationist, vol. 10, no. 4, pp. 13, 26–27. 1933.

Lewis, G. Edward. Notice of the discovery of *Plesiogulo brachygnathus* in the Siwalik measures of India. Amer. Journ. Sci., vol. 26, no. 151, p. 80. July, 1933.

Loomis, F. B. Three oreodont skeletons from the lower Miocene of the great plains. Bull. Geol. Soc. America, vol. 44, pp. 723–734, figs. 9. August 31, 1933.

Lyon, Marcus Ward, Jr. Two new records of the least weasel in Indiana. Amer. Midland Nat., vol. 14, no. 4, pp. 345–349, figs. 2. July, 1933.

M. ———, R. What we owe to wild life. A survey of the Empire's big game today. Field, London, vol. 162, no. 4204, pp. 226–227, figs. July 22, 1933.

Mackenzie, J. M. D. Fur farming. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 988–992. December 15, 1933.

Maclatchy, A. R. Les buffles du Gabon (Régions du Fernan-Vaz et de la N'Gounié). Terre et Vie, vol. 2, no. 10, pp. 584–596, figs. 11. October, 1932.

Maistre, Edouard. Des infiltrations de sangliers dans le Bas-Languedoc. Bull. Soc. Nat. Acclimat. France, vol. 80, no. 7, pp. 249–258. July, 1933.

Manresa, Miguel. Inheritance of resistance and susceptibility to infectious abortion. Journ. Infectious Diseases, vol. 51, pp. 30–71, figs. 16. July–August, 1932.

——— Physiology of reproduction in the rabbit—age of sexual maturity, breeding season, duration of normal pregnancy, and ovulation. Philippine Journ. Sci., vol. 51, no. 3, pp. 323–330. July, 1933.

McCann, C. Observations on some of the Indian langurs. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 3, pp. 618–628, pls. 1–2. August 15, 1933.

——— Notes on some Indian macaques. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 796–810, pls. 1–5. December 15, 1933.

McLeod, J. A. A parasitological survey of the genus *Citellus* in Manitoba. Canadian Journ. Research, vol. 9, no. 2, pp. 108–127, pl. 1, figs. 18. August, 1933.

Merriam, John C., and Chester Stock. Tertiary mammals from the auriferous gravels near Columbia, California. Contrib. to Palaeont., Carnegie Inst. Washington, Publ. 440, pp. 1–6, figs. 2. November 15, 1933.

Moment, Gairdner Bostwick. The effects of rate of growth on the post-natal development of the white rat. Journ. Exper. Zool., vol. 65, no. 3, pp. 359–393. July 5, 1933.

Morris, R. C. Panthers feeding on tiger kills. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 3, p. 742. August 15, 1933.

——— Wild dogs driving a panther from its 'kill.' Journ. Bombay Nat. Hist. Soc., vol. 36, no. 3, pp. 744–745. August 15, 1933.

——— A spirited old bull bison (*Bibos gaurus*). Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 984–985. December 15, 1933.

Murie, Adolph. The ecological relationship of two subspecies of Peromyscus in the Glacier Park Region, Montana. Occas. Papers Mus. Zool., Univ. Michigan, no. 270, pp. 17. July 1, 1933.

Nelson, E. W., and E. A. Goldman. Revision of the pocket gophers of the genus Crateogeomys. Proc. Biol. Soc. Washington, vol. 47, pp. 135–154. June 13, 1934. (New: *Crateogeomys castanops perplanus*, *C. c. lacrimalis*, *C. c. hirtus*, *C. c. angusticeps*, *C. c. consitus*, *C. c. tamaulipensis*, *C. c. convexus*, *C. c.*

excelsus, C. c. subsimus, C. c. subnubilus, C. c. planifrons, C. c. rubellus, C. c. peridoneus, Crateogeomys merriami saccharalis, C. m. irolonis, Crateogeomys fulvescens subluteus.)

OGNEV, S. I. Materialien zur Systematik, Morphologie und Zoogeographie der paläarktischen Spitzmäuse. Zool. Anz., vol. 105, nos. 3–4, pp. 77–85. December 15, 1933.

O'KANE, F. Whales washed ashore. Field, London, vol. 162, no. 4201, p. 44, figs. July 1, 1933. (Photograph of ziphioid whale on the Connemara coast.)

OMMANNEY, F. D. Whaling in the Dominion of New Zealand. Discovery Reports, Cambridge, England, vol. 7, pp. 239–252, fig. 1, pls. 11–13. 1933.

O'NEAL, HERBERT. Mountain weasel makes a kill. Yosemite Nature Notes, vol. 12, no. 11, p. 101. November, 1933.

ORR, ROBERT T. Two new woodrats from Lower California, Mexico. Proc. Biol. Soc. Washington, vol. 47, pp. 109–112. June 13, 1934. (New: *Neotoma lepida egressa, Neotoma fuscipes martirensis.*)

PARNELL, I. W., and T. W. M. CAMERON. Some observations on the ecology of Scottish herbivores and carnivores. Scottish Nat., no. 203, pp. 139–145. September–October, 1933.

PARR, ARTHUR J. An inveterate poacher. Field, London, vol. 162, no. 4201, p. 45, figs. July 1, 1933. (Photograph of a stoat.)

PATTERSON, BRYAN. A contribution to the osteology of Titanoides and the relationships of the Amblypoda. Proc. Amer. Philos. Soc., vol. 73, no. 2, pp. 71–101, figs. 13, pls. 2. November 29, 1933. (New: Titanoidinae.)

PEACOCK, E. H. Control of wild elephants in Burma. Field, London, vol. 162, no. 4210, pp. 592–593, figs. September 2, 1933.

———— In ambush for bison. A big game photographer's fortune and misfortune in Burma. Field, London, vol. 162, no. 4212, pp. 714–715, figs. September 16, 1933.

PEMBERTON, C. E. Cost of rats to industry, especially sugar, and methods of control. Journ. Pan-Pacific Res. Inst., Honolulu, vol. 8, no. 3, pp. 3–5. July–September, 1933.

PETERSON, O. A. New titanotheres from the Uinta Eocene in Utah. Annals Carnegie Mus., vol. 22, nos. 3–4, pp. 351–361, figs. 3, pls. 16–18. April 10, 1934. (New: *Diplacodon progressum, Sthenodectes priscus.*)

PHILLIPS, W. W. A. Survey of the distribution of mammals in Ceylon. Spolia Zeylanica, Ceylon Journ. Sci., sec. B vol. 18, pt. 1, pp. 133–142. December 22, 1933.

PILGRIM, GUY E. Two new species of sheep-like antelope from the Miocene of Mongolia. Amer. Mus. Novitates no. 716, pp. 1–29, figs. 12. May 2, 1934. (New: *Oioceros* (?) *grangeri, Oioceros* (?) *noverca,* and *Oioceros* (?) *mecquenemi* for Maragha skull called *Oioceros rothii* by De Mecquenem in 1925.)

PILLAI, DANUSHKATI. Curious death of cheetal (*Axis axis*) in captivity. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 986–988. December 15, 1933.

PREBLE, EDWARD A. Facts about our fur seals. Nat. Humane Rev., vol. 21, no. 11, pp. 22–23. November, 1933.

PUSTET, A. Die Bekämpfung der Bisamratte. Prakt. Blätter Pflanzenbau und Pflanzensch., vol. 8, no. 4, pp. 80–98. July, 1930.

———— Die Bekämpfung der Bisamratte in Bayern in den Jahren 1929–1931. Prakt. Blätter. Pflanzenbau und Pflanzensch., vol. 10, nos. 9–10, pp. 222–242, map. 1933.

RAADT, O. L. E. DE. De identiteit van Rattus bukit Bonhote. Zool. Mededeel., Leiden, vol. 16, nos. 1–2, p. 30. September 1, 1933. (*Rattus jerdoni* Blyth = *R. bukit* (Bonhote).)

RAADT, O. L. E. DE. De namen der in Nederlandsch-Indië voorkomende ratten. Zool. Mededeel., Leiden, vol. 16, nos. 1–2, pp. 31–32. September 1, 1933. (Lists rats occurring in Dutch East Indies.)

RADCLIFFE, LEWIS. Economics of the whaling industry with relationship to the convention for the regulation of whaling. Special Committee on the Conservation of Wild Life Resources, United States Senate, 73d Congress, 2d Session, pp. 79. July 27, 1933.

———— The whaling industry. Industrial and Engineering Chemistry, vol. 25, no. 7, pp. 764–767, figs. 2. July, 1933.

RAVEN, H. C. Further adventures of Meshie. A chimpanzee that has lived most of her life in a New York suburban home. Natural History, New York, vol. 33, no. 6, pp. 607–617, figs. 12. November–December, 1933.

REDINGTON, PAUL G. The United States Bureau of Biological Survey. Scientific Monthly, pp. 289–306, figs. 24. October, 1933.

REYMOND, A. Note sur les Équidés sauvages rencontrés en Asie Centrale par la Mission Haardt-Audouin-Dubreuil. Bull. Mus. Nat. Hist. Nat., Paris, vol. 4, no. 7, pp. 807–809, map. November, 1932.

RIIS, PAUL B. Wild life in our National Parks. Parks and Recreation, vol. 17, no 4, pp. 141–148, figs. December, 1933.

RUSBY, L. F. Two experiences with panther. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 3, pp. 743–744. August 15, 1933.

RUSCONI, CARLOS. Nuevos Restos de Monos Fósiles del Terciario Antiguo de la Patagonia. Anal. Soc. Cient. Argentina, Buenos Aires, vol. 116, pp. 286–289. 1933. (New: *Homunculus harringtoni*.)

———— La vida animal a fines del terciario superior en Buenos Aires. El Monitor de la Educación Común, Buenos Aires, pp. 65, figs. 31. August, 1933.

———— Tercera Noticia sobre los Vertebrados Fósiles de la Arenas Puelchenses de Villa Ballester. Anal. Soc. Cient. Argentina, Buenos Aires, vol. 117, no. 1, pp. 19–37, figs. 6. January, 1934. (New: *Xenohydrochoerus, X. ballesterensis, Tapiralum, Tapirus* (*Tapiralum*) *greslebini, Onohippidion saldiasi puelchensis, ?Antifer crassus*.)

———— Apuntes sobre la Evolución Ontogenética de los Molares del Género Agouti (Rodentia). Revista Odontológica, pp. 1–10, figs. 11. April 1934.

SALVESEN, HAROLD KEITH. Modern whaling in the Antarctic. Journ. Roy. Soc. Arts, vol. 81, no. 4191, pp. 408–423. March 17, 1933. (Discussion, pp. 424–429.)

SANBORN, ELWIN R. The rodents or gnawing animals. Bull. New York Zool. Soc., vol. 36, no. 6, pp. 143–175, figs. November–December, 1933.

SCHAUB, S. Über einige fossile Simplicidentaten aus China und der Mongolei. Abhandl. Schweizerischen Palaeont. Gesell., Basel, vol. 54, pp. 1–40, figs. 31, pl. 1. 1934. (New: *Brachyscirtetes* for *Alactaga wimani* Schlosser, *Plesiocricetodon* for *Plesiodipus lcei* Young, *Neocricetodon* for *Cricetulus grangeri* Young, *Nannocricetulus, N. mongolicus, Pseudomeriones* for *Lophocricetus abbreviatus* Teilhard, *Lophocricetus pusillus, Anatolomys, A. teilhardi, Microtoscoptes, M. praetermissus*.)

SCHEFFER, THEO. H. Breeding of the Washington varying hare. Murrelet, vol. 14, no. 3, pp. 77–78. September, 1933. (*Lepus washingtonii*.)

———— Replacement-and-increase ratio in species. Murrelet, vol. 14, no. 3, pp. 51–54. September, 1933.

SCHULTZ, ADOLPH H. Observations on the growth, classification and evolutionary specialization of gibbons and siamangs. Human Biology, vol. 5, no. 2, pp. 212–255, figs. 9, pl. 1, May, 1933; no. 3, pp. 385–428, fig. 10, pls. 2–3, September, 1933.

SCHWARZ, ERNST. The Hyrax of the Central Sahara. Ann. and Mag. Nat. Hist., London, ser. 10, vol. 12, pp. 625–626. December, 1933.

——— On the local races of the chimpanzee. Ann. and Mag. Nat. Hist., London, ser. 10, vol. 13, no. 78, pp. 576–583. June, 1934. (New: *Pan satyrus verus*.)

SEEMAN, ALBERT L. Development of reindeer activities in Alaska. Economic Geography, vol. 9, no. 3, pp. 292–302, figs. 13. July, 1933.

SHAPIRO, H. L. Man—500,000 years from now. Trends and influences now at work in changing or modifying the physical characteristics of civilized man—A scientific attempt to forecast what may occur in the future evolution of man. Natural History, New York, vol. 33, no. 6, pp. 582–595, figs. 9. November–December, 1933.

SHELDON, H. H. The deer of California. Santa Barbara Mus. Nat. Hist., Occas. papers no. 3, pp. 71, pls. 19, map. November 1, 1933. (An account of the six races of *Odocoileus*, including ranges, characters, habits, enemies, methods of hunting, and the like.)

SHEPPARD, W. B. Jacksons Hole not for elk. The New York Times, Sunday, May 20, 1934, p. E 5.

SIMPSON, GEORGE G. Stratigraphic nomenclature of the early Tertiary of central Patagonia. Amer. Mus. Novitates no. 644, pp. 13, figs. 2. July 5, 1933.

——— Critique of a new theory of mammalian dental evolution. Journ. Dental Research, vol. 13, no. 4, pp. 261–272. August, 1933.

——— The ear region and the foramina of the cynodont skull. Amer. Journ. Sci., vol. 26, pp. 285–294, figs. 5. September, 1933. (Of interest on account of mammalian-reptilian bone homologies.)

——— A Nevada fauna of Pleistocene type and its probable association with man. Amer. Mus. Novitates no. 667, pp. 10, figs. 5. Otober 23, 1933.

——— Glossary and correlation charts of North American Tertiary mammal-bearing formations. Bull. Amer. Mus. Nat. Hist., New York, vol. 67, art. 3, pp. 79–121, figs. 8. November 25, 1933.

——— Paleobiology of Jurassic mammals. Palaeobiologica, Wien, vol. 5, pp. 127–158, figs. 6. 1933.

SKEFFINGTON, J. WHYTE-MELVILLE. Charms of the forest. Points of view on stalking and driving the red deer. Field, London, vol. 162, no. 4213, pp. 766–767, figs. September 23, 1933.

SMITH, WILBUR K. Motor cortex of the bear (*Ursus americanus*). A physiologic and histologic study. Archiv. Neur. and Psych., vol. 30, pp. 14–39, figs. 10. July, 1933.

——— Cerebral hemispheres of the American black bear (*Ursus americanus*). Morphologic and phylogenetic characteristics. Archiv. Neur. and Psych., vol. 30, pp. 1–13, figs. 8. July, 1933.

SOWERBY, ARTHUR DE C. The rodents and lagomorphs of China. China Journ., vol. 19, no. 4, pp. 189–207, figs. October, 1933.

——— An embalmed whale in Shanghai. China Journ., vol. 19, no. 4, pp. 210–211, figs. October, 1933. (*Eubalaena glacialis*.)

——— The pandas or cat bears and the true bears. China Journ., vol. 19, no. 5, pp. 257–259, figs. November, 1933.

SPIKER, CHAS. J. Some late winter and early spring observations on the white-tailed deer of the Adirondacks. Roosevelt Wild Life Bull., Syracuse, vol. 6, no. 2, pp. 327–385, figs. 170–227, maps 3–9. October, 1933.

STANEK, V. J. K. topografické a srovnávací anatomii sluchového orgánu našich Chiropter. České Akademie věd a Uměni, Prague, pp. 1–67, figs. 8, pls. 1–9. 1933. (Structure of auditory region of Chiroptera skulls.)

STEHLIN, H. G. Ein Ovibosfund aus dem Kanton Bern. Eclogae Geol. Helvetiae, vol. 26, no. 2, pp. 225–229, figs. 3. December, 1933.

——— Über die fossilen Asiniden Europas. Eclogae Geol. Helvetiae, vol. 26, no. 2, pp. 229–232. December, 1933.

STENDALL, J. A. SIDNEY. Badgers at home in County Down. Irish Naturalists' Journ., vol. 4, no. 11, pp. 218–219. September, 1933. (Observations on a family at play.)

STEPHEN, A. C. Killer whale (*Orcinus orca*) at Fair Isle. Scottish Nat., no. 202, p. 125. July–August, 1933.

STIRTON, R. A. A critical review of the Mint Canyon mammalian fauna and its correlative significance. Amer. Journ. Sci., vol. 26, pp. 569–576. December, 1933.

ST. LEGER, J. On a new species of shrew from Merifano, East Africa. Ann. and Mag. Nat. Hist., London, ser. 10, vol. 13, no. 77, pp. 559–560. May, 1934. (New: *Crocidura macarthuri*.)

STOCK, CHESTER. Microsyopsinae and Hyopsodontidae in the Sespe Upper Eocene, California. Proc. Nat. Acad. Sci., vol. 20, no. 6, pp. 349–354, pl. 1. June 15, 1934. (New: *Crascops, C. sylvestris, Hyopsodus egressus*.)

SVIHLA, ARTHUR. Occurrence of a colony of albino ground squirrels near Pullman, Washington. Murrelet, vol. 14, no. 3, p. 78. September, 1933.

SWAINE, I. K. A tiger attacking an elephant. Journ. Bombay Nat. Hist. Soc., vol. 36, no. 4, pp. 983–984. December 15, 1933.

SWALES, W. E. *Skrjabinema oreami* sp. nov., a nematode parasite of *Oreamnos americanus* and *Rangifer* sp. in Canada. Canadian Journ. Research, vol. 10. no. 5, pp. 527–531, figs. May, 1934.

SWEZY, OLIVE. The changing concept of ovarian rhythms. Quart. Rev. Biol., Baltimore, vol. 8, no. 4, pp. 413–433. December, 1933.

TAKASHIMA, HARUO. A hand-list of Japanese marine mammals. Trans. Nat. Hist. Soc. Formosa, vol. 23, nos. 126–127, pp. 249–258. August, 1933.

TATE, G. H. H. A systematic revision of the marsupial genus Marmosa. Bull. Amer. Mus. Nat. Hist., vol. 66, art. 1, pp. 1–250, figs. 29, pls. 26, 1 table (9 sections). August 10, 1933.

——— Taxonomic history of the neotropical hares of the genus Sylvilagus, subgenus Tapeti. Amer. Mus. Novitates no. 661, pp. 10. September 26, 1933.

THAXTER, B. A. Black bears as mothers. Yosemite Nature Notes, vol. 12, no. 9, pp. 84–86. September, 1933.

TIETZ, ESTHER BOGEN. The humoral excitation of the nesting instincts in rabbits. Science, n. s., vol. 78, no. 2023, p. 316. October 6, 1933.

TINKLEPAUGH, O. L. Sex cycles and other cyclic phenomena in a chimpanzee during adolescence, maturity, and pregnancy. Journ. Morphol., vol. 54, no. 3, pp. 521–546, figs. 4, pl. 1. June 5, 1933.

TOKUNAGA, SHIGEYASU. A list of the fossil land mammals of Japan and Korea with descriptions of new Eocene forms from Korea. Amer. Mus. Novitates no. 627, pp. 7, figs. 2. May 27, 1933.

TOWNSEND, M. T., and M. W. SMITH. The white-tailed deer of the Adirondacks. Roosevelt Wild Life Bull., Syracuse, vol. 6, no. 2, pp. 153–326, figs. 75–169, pls. 4–5. October, 1933.

TURKEWITSCH, B. G. Vergleichend-anatomische Untersuchungen über das Knöcherne Labyrinth der Säugetiere (Ampullae). Anat. Anz., Jena, vol. 76, nos. 12–13, pp. 206–214, figs. 6. July 10, 1933.

——— Zur Anatomie des Gehörorganes der Säugetiere (Canales semicirculares). Anat. Anz., Jena, vol. 76, nos. 21–22, pp. 269–408, figs. 14. September 15, 1933.

VANDERHOFF, V. L. A skull of *Pliohippus tantalus* from the later Tertiary of the Sierran foothills of California. Univ. Calif. Publ., Bull. Dept. Geol. Sci., vol. 23, no. 5, pp. 183–194, figs. 5, pl. 16. August 11, 1933.

VAN LONE, ELDYN EVERETT. The inheritance, histology, and physiology of a new type of sterility, sexual hypogenesis, in the guinea-pig. Journ. Exper. Zool., vol. 64, no. 1, pp. 1–29, pl. 1. November, 1932.

VERLAINE, L., and P. GALLIS. L'intelligence des Singes inférieurs. Mém. Soc. Roy. Sci. de Liége, ser. 3, vol. 17, fasc. 3, pp. 1–48. 1932. (After experimenting with an immature *Macaca sinica* the authors conclude that "The lower primate has the same intellectual implement as man. He is inferior to man simply because he has not very much ability for forming brief synthetic concepts of the complex psycho-physiological operations, of which he is constantly the theatre, in such a manner that he can use each of his discoveries, instantly and under all circumstances for accomplishing new advances. Thus he thinks essentially as we do, but less than we do.")

WALKER, WARD D. Raising beaver in captivity. Parks and Recreation, vol. 17, no. 4, pp. 138–141. December, 1933.

WEIGELT, JOHANNES. Die Biostratonomie der 1932 auf der Grube Cecilie im mittleren Geiseltal ausgegrabenen Leichenfelder. Nova Acta Leopoldina, Halle a.S., n.F., vol. 1, nos. 2–3, pp. 157–174, figs. 2, pls. 27–30. 1933.

WHITLOW, WAYNE B., and E. RAYMOND HALL. Mammals of the Pocatello region of southeastern Idaho. Univ. Calif. Publ. in Zool., vol. 40, no. 3, pp. 235–276, figs. 3. September 30, 1933.

WILSON, ROBERT W. Pleistocene mammalian fauna from the Carpinteria asphalt. Contrib. to Palaeont., Carnegie Inst. Washington, Publ. 440, pp. 59–76. November 15, 1933.

WISLOCKI, GEORGE B. On the placentation of the harbor porpoise (*Phocaena phocoena* (Linnaeus)). Biol. Bull., vol. 65, no. 1, pp. 80–98, pls. 5. August, 1933.

———— The reproductive systems. Chapter 11 (pp. 231–247) of: The Anatomy of the Rhesus Monkey (19 contributors, pp. ix + 383, illus.), edited by Carl G. Hartman and William L. Straus, Jr. Baltimore: The Williams and Wilkins Co., December 1, 1933. Price $6.00.

———— Location of the testes and body temperature in mammals. Quart. Review Biol., Baltimore, vol. 8, no. 4, pp. 385–396. December, 1933.

———— Observations on the descent of the testes in the macaque and in the chimpanzee. Anat. Rec., vol. 57, no. 2, pp. 133–148, figs. 7. September 25, 1933.

———— Gravid reproduction tract and placenta of the chimpanzee. Amer. Journ. Phys. Anthrop., vol. 18, no. 1, pp. 81–92, pls. 2. July–September, 1933.

WOOD, HORACE ELMER, 2ND. Revision of the Hyrachyidae. Bull. Amer. Mus. Nat. Hist., vol. 67, no. 5, pp. 181–295, figs. 51, pls. 20–24. May 26, 1934. (New: *Hyrachyus hypostylus, Hyrachyus douglassi, Metahyrachyus troxelli, Ephyrachyus, Ephyrachyus cristalophus.*)

———— and ALBERT ELMER WOOD. Daemonhelix in the Pleistocene of Texas. Journ. Geol., vol. 41, no. 8, pp. 824–833, figs. 5. November–December, 1933.

WOOD, ALBERT ELMER, and HORACE ELMER WOOD, II. The genetic and phylogenetic significance of the presence of a third upper molar in a modern dog. Amer. Midland Nat., Notre Dame, vol. 14, no. 1, pp. 36–48, figs. 3. November–December, 1933.

YUDIN, H. C., and H. F. HARLOW. Comparative behavior of primates. V. Delayed reactions in Primates in horizontal and vertical planes. Journ. Comp. Psych., vol. 16, no. 1, pp. 143–146, pl. 1. August, 1933.

ZUCKERMAN, S. Functional affinities of man, monkeys, and apes. A study of the bearings of physiology and behavior on the taxonomy and phylogeny of lemurs, monkeys, apes, and man. New York: Harcourt, Brace and Company, pp. xviii + 203, figs. 24. December 1, 1933. $3.00.

LIST OF MEMBERS OF THE AMERICAN SOCIETY OF MAMMALOGISTS

(Corrected to July 10, 1934)

Names of life members are marked with an asterisk

Honorary Members

*MERRIAM, DR. C. HART, 1919 16th St., Washington, D. C.....(Charter) 1930
OSBORN, DR. HENRY FAIRFIELD, American Museum of Natural History, New York City.....(Charter) 1929
WEBER, PROF. DR. MAX, Eerbeek, Holland..... 1928

Members

ABBOTT, CLINTON G., Natural History Museum, San Diego, Calif..... 1922
*ABBOTT, DR. WILLIAM L., North East, Md.....Charter
ADAMS, DR. CHAS. C., State Museum, Albany, N. Y.....Charter
ADAMS, WILLIAM C., Dept. of Conservation, State Office Bldg., Albany, N. Y..... 1933
AGACINO, E. MORALES, Museo Nacional de Ciencias Naturales, Madrid (6), Spain. 1933
AGERSBORG, DR. H. P. KJERSCHOW, Dept. of Fisheries and Game, Concord, N. H.. 1921
AGOSTINI, C. T., Carnegie Museum, Pittsburgh, Pa..... 1931
AHRENS, DR. THEODOR G., Waitzstr. 24. III, Charlottenburg 4, Berlin, Germany. 1921
AKELEY, MRS. MARY L. J., American Museum Natural History, New York City... 1928
ALBRIGHT, DR. HORACE M., 342 Madison Ave., New York City.....Charter
ALDOUS, CLARENCE M., 1358 Keston St., St. Paul, Minn..... 1931
ALDOUS, SHALER E., 2644 Columbine St., Denver, Col..... 1927
*ALEXANDER, MISS ANNIE M., Suisun, Calif.....Charter
ALLAN, PHILIP F., West Lebanon, N. H..... 1931
ALLEN, DR. ARTHUR A., McGraw Hall, Ithaca, N. Y.....Charter
*ALLEN, DR. GLOVER M., Museum of Comparative Zoology, Cambridge, Mass...Charter
ALLEN, OLIVER, City Y. M. C. A., Athens, Ga..... 1934
*ALLIS, DR. EDWARD P., JR., Palais de Carnoles, Menton, France..... 1922
ALLISON, VERNON C., Picatinny Arsenal, Dover, N. J..... 1930
ANDERSON, HARVEY T., 3062 Weldon Ave., Los Angeles, Calif..... 1932
ANDERSON, DR. RUDOLPH M., National Museum of Canada, Ottawa, Canada...Charter
ANDREWS, DR. ROY C., American Museum of Natural History, New York City .Charter
ANTHONY, A. W., 3311½ 30th St., San Diego, Calif.....Charter
ANTHONY, DR. H. E., American Museum of Natural History, New York City....Charter
APGAR, CHARLES S., JR., 231½ North St., Harrisburg, Pa..... 1927
APPLEBAUM, EDMUND, 730 5th Ave., New York City..... 1930
*ARCHBOLD, RICHARD, American Museum of Natural History, New York City..... 1929
ARTHUR, STANLEY C., 1309 State St., New Orleans, La..... 1925
ASCHEMEIER, C. R., U. S. National Museum, Washington, D. C.....Charter
ASHLEY-MONTAGU, DR. MONTAGUE F., College of Dentistry, 209 East 23rd St., New York City..... 1934

*Atkinson, Harry W., 10 Bishop Road, Guilford, Baltimore, Md..... 1925
Austin, Oliver L., Sr., North Eastham, Cape Cod, Mass..... 1930
Badé, Dr. William F., 2616 College Ave., Berkeley, Calif.....Charter
Bailey, Alfred M., Chicago Academy of Sciences, Chicago, Ill.....Charter
Bailey, Bernard, R. F. D. No. 1, Box 22, San Marcos, Calif.....Charter
Bailey, Harold H., 820 Alhambra Circle, Coral Gables, Fla.....Charter
Bailey, John W., University of Richmond, Richmond, Va..... 1927
*Bailey, Vernon, San Marcos, Calif.....Charter
Baird, Katherine B., 815 Webster St , N.W., Washington, D. C.....Charter
Baldwin, C. N., Wm. R. Hearst's Zoological Gardens, San Simeon, Calif..... 1931
*Baldwin, S. Prentiss, 11025 East Boulevard, Cleveland, Ohio..... 1922
Ball, Edward M., East Falls Church, Virginia.....Charter
Ball, W. Howard, 1861 Ingleside Ter., N.W., Washington, D. C..... 1925
*Bannon, Henry, First National Bank Bldg., Portsmouth, Ohio..... 1922
*Barbour, Dr. Thomas, Museum of Comparative Zoology, Cambridge, Mass....Charter
Barkalow, Fred, S., Jr., 207 Washington Ave., Marietta, Ga..... 1934
Barnes, Claude T., 359 10th Ave., Salt Lake City, Utah.....Charter
Barrett, Charles H. M., 1339 Valley Place, S.E., Washington, D. C.....Charter
Barrett, Leonard I., 223 Federal Bldg., Asheville, N. C..... 1932
Barrett, Dr. Otis W., North Clarendon, Vermont..... 1934
Bartelmez, Prof. George W., University of Chicago, Chicago, Ill..... 1931
Bartlett, Ilo H., Department of Conservation, Lansing, Mich..... 1930
Bartsch, Dr. Paul, U. S. National Museum, Washington, D. C..... 1921
Bassett, Frank N., 11001 Euclid Ave., Cleveland, Ohio..... 1921
Batchelder, Chas. F., 7 Kirkland St., Cambridge, Mass.....Charter
Bauman, John E., Hotel Taylor, 920 North Taylor St., St. Louis, Mo..... 1923
Bay, J. Christian, The John Crear Library, 86 E. Randolph St., Chicago, Ill.. 1931
*Beach, William N., 551 Fifth Ave., New York, N. N. Y.....Charter
Beaufort, Prof. Dr. Lieven F. de, 53 Plantage Middenlaan, Amsterdam C., Holland..... 1930
Beaux, Prof. Oscar de, Via Brigata Liguria 9, Genoa, Italy..... 1930
Bebb, Dr. William, 431 E. Washington St., Oakland City, Ind..... 1930
Beebe, Dr. William, 33 West 67th St., New York City.....Charter
Bell, Dr. W. B., 803 Rittenhouse St., N.W., Washington, D. C.....Charter
Benson, John T., Nashua, N. H..... 1923
Benson, Dr. Seth B., Museum of Zoology, University of Michigan, Ann Arbor, Mich..... 1928
Bergtold, Dr. W. H., 1159 Race St., Denver, Colo.....Charter
Berlin, Miss Leonore A., 807 Comstock Ave., Syracuse, N. Y..... 1931
Berry, Elverton C., Box 234, Conway, N. H..... 1924
Bicknell, Mrs. F. T., 319 S. Normandie Ave., Los Angeles, Calif..... 1926
Bird, Dr. Ralph D., Dominion Entomological Laboratory, Box 250, Brandon, Manitoba, Canada..... 1926
Birdseye, Clarence, Birdseye Laboratories, Gloucester, Mass..... 1933
Bishop, Dr. Louis B., 450 Bradford St., Pasadena, Calif..... 1927
Bishop, Dr. Sherman C., Dept. of Biology, University of Rochester, Rochester, N. Y.....Charter
Blaauw, Dr. F. E., Gooilust, 'sGraveland, Hilversum, Holland..... 1921
Black, John David, Museum of Birds and Mammals, University of Kansas, Lawrence, Kansas..... 1933
Blain, Dr. Alex W., 2201 Jefferson Ave., E., Detroit, Mich..... 1926
Blair, Dr. W. Reid, New York Zoological Society, New York City..... 1927

BLAKE, PROF. IRVING H., Dept. of Zoology, University of Nebraska, Lincoln, Neb.....Charter
BLANCHARD, DR. FRANK N., Dept. of Zoology, University of Michigan, Ann Arbor, Mich..... 1923
BLANCOU, LUCIEN, 16, Rue Montmailler, Limoges (Haute-Vienne) France..... 1932
BLOEKER, JACK C. VON, JR., 4507 Gilbert Place, Los Angeles, Calif..... 1927
BLOSSOM, PHILIP M., 2002 Geddes Ave., Ann Arbor, Mich..... 1929
BLUNTSCHLI, PROF. DR. HANS, Aebistrasse, 9- Bern, Switzerland..... 1930
BODE, FRANCIS D., 45 E. Laurel St., Sierra Madre, Calif..... 1931
BOLE, BENJAMIN P., JR., Lake Shore Boulevard & Bratenabl Road, Cleveland, Ohio..... 1930
BOLT, BENJAMIN F., 5300 Brookside Boulevard, Kansas City, Mo.....Charter
*BORDEN, JOHN, Box 442, Muskegon, Mich..... 1928
BORELL, ADREY E., Yosemite National Park, Calif..... 1925
BORISSIAK, DR. A. A., Academy of Sciences, Leningrad, U. S. S. R..... 1933
BOWDISH, BEECHER S., Demarest, N. J..... 1921
BRADLEY, ROBERT McL., 615 Catherine St., Ann Arbor, Mich..... 1928
BRADSHAW, F., Director Provincial Museum, Normal School, Regina, Saskatchewan, Canada.....Charter
BRADT, G. W., Zoology Dept., Michigan State College, East Lansing, Mich..... 1927
BRAESTRUP, F. W., St. Kannikestraede 9, Copenhagen K., Denmark..... 1934
BRAND, ALBERT RICH, American Museum of Natural History, New York City..... 1933
*BRANDRETH, COURTENAY, Ossining, N. Y..... 1921
BRASSARD, DR. A., Quebec Zoological Garden, Charlesbourg, Quebec, Canada..... 1932
BRECK, MRS. EDWARD, The Dupont Circle, 1343 19th St., Washington, D. C..... 1930
BRECKENRIDGE, W. J., Museum of Natural History, University of Minnesota, Minneapolis, Minn..... 1932
BREWER, DR. GEORGE E., 151 East 79th St., New York City..... 1934
BRIMLEY, H. H., State Museum, Raleigh, N. C.....Charter
BRINKMANN, DR. AUGUST, Bergen Museum, Bergen, Norway..... 1921
BRODE, PROF. H. S., 433 E. Alder St., Walla Walla, Wash.....Charter
BRONGERSMA, L. D., Bloemendaalscheweg 84, Bloemendaal, Holland..... 1930
BRONNER, HEDIN, 208 West 23rd St., New York City..... 1933
BROOKS, MAJ. ALLAN, Okanagan Landing, British Columbia, Canada.....Charter
BROOKS, REV. EARLE A., 166 Plymouth Road, Newton Highlands, Mass..... 1921
BROSIUS, RALPH R., Valentine, Neb..... 1932
BROWN, DR. BARNUM, American Museum of Natural History, New York City..... 1926
BROWN, C. EMERSON, Philadelphia Zoological Garden, Philadelphia, Pa.....Charter
BROWN, F. MARTIN, Fountain Valley School, Colorado Springs, Colo..... 1926
BROWN, WILLIAM L., U. S. National Museum, Washington, D. C.....Charter
BRYANT, DR. HAROLD C., National Park Service, Dept. of the Interior, Washington, D. C.....Charter
BULLOCK, D. S., El Verjel, Angol, Chile..... 1921
BURGESS, THORNTON W., 61 Washington Road, Springfield, Mass.....Charter
BURLEIGH, THOMAS D., U. S. Biological Survey, Washington, D. C..... 1930
BURNETT, WM. L., State Agricultural College, Fort Collins, Col.....Charter
BURNHAM, JOHN B., Essex, N. Y..... 1923
BURNS, FRANK L., Berwyn, Pa.....Charter
BURT, DR. CHARLES E., Southwestern College, Winfield, Kansas..... 1932
BURT, WILLIAM H., California Institute of Technology, Pasadena, Calif..... 1926
BUTLER, DR. AMOS W., 52 Downey Ave., Indianapolis, Ind.....Charter
CABOT, WILLIAM B., Terrace St., Brattleboro, Vt..... 1922

CABRERA, ANGEL, Museo de la Plata, La Plata, Argentine.....Charter
CADWALADER, CHARLES M. B., Fort Washington, Pa..... 1930
*CADWALADER, DR. W. B., 133 S. 36th St., Philadelphia, Pa..... 1924
CAHALANE, DR. VICTOR H., Cranbrook Institute of Sciences, Bloomfield Hills, Mich..... 1930
CAHN, DR. ALVIN R., Vivarium Bldg., Champaign, Ill..... 1921
CALDWELL, DR. GEORGE T., University Station, Box 51, Tucson, Ariz..... 1922
CAMPBELL, BERRY, Johns Hopkins Medical School, Baltimore, Md..... 1934
CAMPBELL, DR. J. A., 13 Elm St., Toronto, Ontario, Canada..... 1920
CANTWELL, GEORGE G., Los Angeles Museum, Exposition Park, Los Angeles, Calif.....Charter
CARLISLE, GEORGE L., Jr., Box 29, Newton Square, Pa..... 1926
CARR, WILLIAM H., American Museum of Natural History, New York City..... 1926
*CARROLL, JAMES J., 16 Courtland Place, Houston, Tex..... 1926
CARROLL, DR. MITCHELL, Franklin & Marshall College, Lancaster, Pa..... 1922
CARTER, HAYDEN ANTHONY, Ponce de Leon Court, Apt. 6, Decatur, Ga..... 1933
CARTER, T. DONALD, American Museum of Natural History, New York City... 1922
CASAMAJOR, PROF. LOUIS, College of Physicians & Surgeons, New York City... 1922
CASE, DR. E. C., University Museums, Ann Arbor, Mich.....Charter
CASTLE, DR. WILLIAM E., 186 Payson Road, Belmont, Mass..... 1930
CHAMBERLAIN, EDWARD B., 182 Ashley Ave., Charleston, S. C..... 1923
CHANDLER, WILLIAM H., 5 Hollis Hall, Harvard University, Cambridge, Mass..... 1934
CHAPIN, DR. JAMES P., American Museum of Natural History, New York City..Charter
CHAPMAN, DR. WENDELL S[HERMAN], 2934 Magnolia, Berkeley, Calif..... 1934
CHAPMAN, WILLIAM S., Soda Butte Ranger's Station, Gardiner, Montana..... 1931
CHARTERS, MISS EMMA M., U. S. Biological Survey, Washington, D. C..... 1921
CHASE, HENRY B., JR., 517 Decatur St., New Orleans, La..... 1924
CHAWORTH-MUSTERS, JAMES LAWRENCE, British Museum (Natural History) Cromwell Road, London, S.W.7, England..... 1933
CHEESMAN, WILLIAM H., U. S. Biological Survey, Washington, D. C.....Charter
CHITTICK, HOWARD A., (Address lost)..... 1932
CHURCH, MORTON L., 2209 Sherwood Ave., Charlotte, N. C.....Charter
CLARK, ELTON, Shoreham, Vt.....Charter
CLARK, DR. JAMES L., American Museum of Natural History, New York City..... 1926
CLARK, R. F., 209 E. Arizona Ave., Ruston, La..... 1926
CLARKE, DR. WM. C., Cornwall Bridge, Conn..... 1931
CLEAVES, HOWARD H., Prince Bay, Staten Island, N. Y..... 1923
CLEMENS, WILBERT A., Pacific Biological Station, Nanaimo, B. C., Canada..... 1933
CLEMENTS, DR. FREDERIC E., Mission Canyon, Santa Barbara, Calif..... 1927
COBB, DR. W. MONTAGUE, Dept. of Anatomy, Howard University, Washington, D. C..... 1933
COCKERELL, PROF. T. D. A., 908 10th St., Boulder, Col.....Charter
*COFFIN, H. E., Engineers Club, 32 W. 40th St., New York, N. Y..... 1924
COLBERT, EDWIN H., American Museum of Natural History, New York City..... 1930
*COLBURN, ALBERT E., 716–718 S. Flower St., Los Angeles, Calif.....Charter
COLE, DR. LEON J., College of Agriculture, University of Wisconsin, Madison, Wis..... 1922
COLEMAN, ROBERT H., 4 Green St., Charleston, S. C..... 1928
COLLINS, HENRY H., JR., 1213 St. Matthews Court, Washington, D. C..... 1932
COLLINS, DR. HOMER H., Dept. of Zoology, University of Pittsburgh, Pittsburgh, Pa..... 1921
*COLTON, DR. HAROLD S., Box 127, Flagstaff, Ariz..... 1927

COMPTON, LAWRENCE V., Museum of Vertebrate Zoology, Berkeley, Calif..... 1929
CONGER, PROF. ALLEN C., Ohio Wesleyan University, Delaware, Ohio.....Charter
COOK, MISS FANNYE A., 607 North State, Jackson, Miss..... 1925
COOK, HAROLD J., Cook Museum of Natural History, Agate, Sioux County, Neb... 1925
COOKE, MISS MAY T., 2572 University Place, Washington, D. C.....Charter
COOLIDGE, DANE, Dwight Way End, Berkeley, Calif.....Charter
COOLIDGE, HAROLD J., JR., Museum of Comparative Zoology, Cambridge, Mass... 1926
COPE, FRANCIS R., JR., Dimock, Pa..... 1926
COPELAND, DR. MANTON, Bowdoin College, Brunswick, Maine.....Charter
COTTAM, CLARENCE, U. S. Biological Survey, Washington, D. C..... 1929
COWAN, IAN MCT., Museum of Vertebrate Zoology, Berkeley, Calif..... 1933
CRAIG, WILLIS G., 714 Alvarado St., Redlands, Calif..... 1929
CRANDALL, LEE S., New York Zoological Park, New York City..... 1922
CRIDDLE, STUART, Treesbank, Manitoba, Canada.....Charter
CRILE, ROBERT, 2620 Derbyshire Road, Cleveland, Ohio..... 1934
CROSS, W. REDMOND, Bernardsville, N. J..... 1922
*CUDAHY, JOHN, (Address lost)..... 1923
CURTISS, HORACE L., Box 126, Paonia, Col..... 1932
*CUTTING, CHARLES SUYDAM, 32 Nassau St., New York City..... 1930
DAILEY, ELRIC J., Ogdensburg, N. Y..... 1930
DAMMERMAN, KAREL W., Zoological Museum and Laboratory, Buitenzorg, Java.....Charter
DANFORTH, DR. STUART T., Box 541, Mayaguez, Puerto Rico..... 1925
DARLING, DR. J. N., U. S. Biological Survey, Washington, D. C..... 1934
DARROW, ROBERT W., Elizabethtown, Essex County, N. Y..... 1932
DART, F. SHELDON, Yellowstone Park, Wyo..... 1931
DAVENPORT, DR. CHAS. B., Cold Spring Harbor, Long Island, N. Y..... 1921
DAVIDSON, MRS. M. E. MCLELLAN, California Academy of Sciences, Golden Gate Park, San Francisco, Calif..... 1926
DAVIS, D. DWIGHT, Field Museum of Natural History, Chicago, Ill..... 1930
DAVIS, ELI, R.R. no. 7, London, Ontario, Canada..... 1930
DAVIS, NORMAN W., Bailey Hall, Ithaca, N. Y..... 1932
DAVIS, W. B., Museum of Vertebrate Zoology, University of California, Berkeley, Calif..... 1934
*DAVIS, WILLIAM T., 146 Stuyvesant Place, Staten Island, N. Y..... 1922
DEARBORN, DR. NED, Hilton Village, Virginia.....Charter
DEICHMANN, MISS ELIZABETH, Museum Comparative Zoology, Cambridge, Mass.. 1925
DE LURY, RALPH E., Dominion Observatory, Ottawa, Ontario, Canada..... 1925
DENISON, ROBERT H., 42 Fletcher St., Winchester, Mass..... 1934
DICE, DR. LEE R., Museum of Zoology, Ann Arbor, Mich.....Charter
DICKINSON, FRANCIS R., 1518 Astor St., Chicago, Ill..... 1930
DILLE, FREDERICK M., P. O. Box 428, Rapid City, S. D.....Charter
DILLEHUNT, HARRY B., JR., 3333 North Charles St., Baltimore, Md..... 1926
DITMARS, DR. RAYMOND L., New York Zoological Park, The Bronx, New York City..... 1921
DIXON, JOSEPH, 328 Hilgard Hall, University of California, Berkeley, Calif.....Charter
*DOLAN, BROOKE, 2ND, Villa Nova, Pa..... 1933
DONAHUE, MRS. R. W., Peabody Museum Library, New Haven, Conn..... 1930
DONALDSON, DR. HENRY H., The Wistar Institute, Philadelphia, Pa.....Charter
DONOHOE, MRS. EILEEN L., 1516 Wilson Avenue, Fresno, Calif..... 1932
DORSH, JOHN B., College, Alaska..... 1934
DOUTT, J. KENNETH, Carnegie Museum Pittsburgh, Pa..... 1927
DOWDEN, MISS ROLENA, 405 1st St., Fairmont, W. Va..... 1932

DUFF, JOHN R., Public Works Dept., Christchurch, New Zealand 1925
DUNN, PROF. E. R., Haverford College, Haverford, Pa 1927
DUNN, DR. LAWRENCE H., Ovid, Seneca County, N. Y 1932
DURRANT, STEPHEN DAVID, Dept. of Zoology, University of Utah, Salt Lake City, Utah 1933
EASTWOOD, SIDNEY K., 301 S. Winebiddle Ave., Pittsburgh, Pa 1929
EDGE, MRS. CHARLES N., 136 E. 67th St., New York City 1930
EDGE, DR. ELTON R., San Bernardino Valley Union Junior College, San Bernardino, Calif 1931
EDINGER, DR. TILLY, Leerbachstrasse 27, Frankfurt, A. M., Germany 1933
EDSON, JOHN M., 90 Marine Drive, Bellingham, Wash ..... Charter
ÉHIK, DR. JULIUS, Hungarian National Museum, Budapest, 80, Hungary 1923
EICHELBERGER, GRAYSON M., (Address lost) 1932
EIFRIG, PROF. C. W. G., 1029 Monroe Ave., River Forest, Ill ..... Charter
EKBLAW, DR. W. ELMER, Clark University, Worcester, Mass 1921
ELFTMAN, DR. HERBERT, Schermerhorn Hall, Columbia University, New York City 1926
ELLIOTT, MRS. JANE S., U. S. Biological Survey, Washington, D. C ..... Charter
*ELLIS, RALPH, JR., 2420 Ridge Road, Berkeley, Calif 1926
ELROD, PROF. MORTON J., 205 South 5th St., E., Missoula, Mont ..... Charter
ELTON, CHARLES, University Museum, Oxford, England 1931
EMLEN, ARTHUR C., Awbury, Germantown, Philadelphia, Pa 1926
EMLEN, JOHN T., JR., 36 School Lane, Germantown, Philadelphia, Pa 1934
ENDERS, DR. ROBERT K., Dept. of Physiology and Zoology, Swarthmore College, Swarthmore, Pa 1924
ENGELS, WILLIAM L., 324 S. Van Buren St., Green Bay, Wis 1930
ENGLAND, HOWELL S., 1431 Lafayette Bldg., Detroit, Mich 1932
ENGLISH, DR. P. F., 235 Hillcrest, East Lansing, Mich 1922
ERRINGTON, DR. PAUL L., Insectary, Iowa State College, Ames, Iowa 1933
EVANS, FRANCIS GAYNOR, 818 16th St., S.E., Cedar Rapids, Iowa 1932
EWING, GIFFORD C., Millbrook, N. Y 1931
EWING, DR. H. E., U. S. National Museum, Washington, D. C 1923
EYERDAM, WALTER J., 9253 Corliss Ave., Seattle, Wash 1931
FARGO, WILLIAM G., 506 Union St., Jackson, Mich 1928
FERDINAND, WILHELM H., Firm of Carl Hagenbeck, Stellingen, Germany 1931
FERRAR, MAJ. B. B., Dublin Zoological Gardens, Phoenix Park, Dublin, Ireland 1927
FESTA, DR. ENRICO, Regio Museo Zoologico, Palazzo Carignano, (108) Torino, Italy 1925
FIGGINS, J. D., Colorado Museum of Natural History, City Park, Denver, Colo. Charter
FILLEY, Oliver D., 49 Broad St., New York City 1930
FINLEY, WILLIAM L., Box 426 A., Route 10, Portland, Oregon ..... Charter
FISHER, DR. A. K., The Plymouth, 1236 11th. St., N. W., Washington, D. C. ..... Charter
FISHER, MISS EDNA M., 2410 Fulton St., Berkeley, Calif 1928
FISHER, DR. G. CLYDE, American Museum of Natural History, New York City ..... Charter
FITCH, HENRY SHELDON, Museum of Vertebrate Zoology, University of California, Berkeley, Calif 1933
FLEMING, J. H., 267 Rusholme Road, Toronto, Ontario, Canada ..... Charter
FOLLETT, RICHARD E., Detroit Club, Detroit, Mich 1926
FORBES, JAMES, 139 Stone Ave., Yonkers, N. Y 1934
FORTUYN, DR. A. B. DROOGLEEVER, Peiping Union Medical College, Peiping, China 1931
FOSTER, FRANK B., P. O. Box H., Haverford, Pa 1926

FOX, DR. HERBERT, Zoological Society of Philadelphia, Philadelphia, Pa..... 1927
FRALEIGH, MRS. P. A., 109 Shelburne Road, Burlington, Vt..... 1931
FRASER, DR. CHARLES McL., University of British Columbia, Vancouver, British Columbia, Canada..... 1921
FRECHKOP, SERGE, Musée royal d'Histoire nat. Belgique, 31 rue Vautier, Bruxelles, Belgium..... 1933
FRENCH, JAMES G., 3628 Saanich Road, Victoria, British Columbia, Canada.... 1926
*FRICK, CHILDS, Roslyn, Long Island, N. Y.....Charter
FRICKE, REINHOLD L., Carnegie Museum, Pittsburgh, Pa..... 1932
FRY, WILLIAM W., 1345 John Jay Hall, Columbia University, New York City.. 1933
*FUGUET, HOWARD, Bullitt Bldg., Philadelphia, Pa..... 1925
FULLER, ARTHUR B., Broadmoor Road, Midland Moor, Mentor, Ohio.....Charter
FULLER, HENRY C., 3704 Huntington St., Washington, D. C..... 1926
FURLONG, E. L., California Institute of Technology, Pasadena, Calif..... 1925
GAIGE, FREDERICK M., Museum of Zoology, Ann Arbor, Mich..... 1929
GARDINER, A. W., 1010 Standard Bank Bldg., Cleveland, Ohio..... 1931
GARLOUGH, F. E., 1063 Milwaukee St., Denver, Col.....Charter
GARRETSON, M. S., 3150 Decatur Ave., New York City..... 1921
GATES, WM. H., University Station, Baton Rouge, La..... 1930
GAULT, BENJAMIN T., 570 Anthony St., Glen Ellyn, Ill.....Charter
GAZIN, DR. C. LEWIS, U. S. National Museum, Washington, D. C..... 1931
GEIST, OTTO W., Museum Dept., Alaska Agricultural College, College, Alaska..... 1931
GHIGI, PROF. ALESSANDRO, Dept. of Zoology, University of Bologna, Bologna, Italy..... 1926
GIANINI, CHARLES A., Poland, N. Y.....Charter
GIBSON, MRS. MARY S., 9303 Montgomery Ave., Chevy Chase, Md..... 1932
GILMORE, MELVIN R., Museum of Anthropology, University of Michigan, Ann Arbor, Mich.....Charter
GILMORE, RAYMOND M., Museum of Comparative Zoology, Harvard College, Cambridge, Mass..... 1926
GLENN, DONALD, Franklin, Pa..... 1926
GLOYD, HOWARD K., Dept. of Zoology, University of Michigan, Ann Arbor, Mich.. 1922
GOFF, CARLOS C., Leesburg Experiment Station Laboratory, Leesburg, Fla..... 1934
GOLDMAN, MAJ. E. A., U. S. Biological Survey, Washington, D. C.....Charter
GOLDMAN, LUTHER J., 499 Colusa Ave., Berkeley, Calif..... 1922
GOLDSMITH, DR. G. W., Box 1611, University Sta., Austin, Tex..... 1922
GOLDSMITH, DR. WM. M., University of Wichita, Wichita, Kansas..... 1924
GOODWIN, GEORGE G., American Museum of Natural History, New York City..... 1921
GORSUCH, D. M., College of Agriculture, University of Arizona, Tucson, Ariz... 1931
GOSLIN, ROBERT, 804 E. Main St., Lancaster, Ohio..... 1931
GRANGE, WALLACE B., Fish Creek, Door County, Wis..... 1923
GRANGER, DR. WALTER W., American Museum of Natural History, New York City.....Charter
GRANT, CLEVELAND P., 620 Greenup St., Covington, Kentucky..... 1926
*GRANT, MADISON, 101 Park Ave., New York City.....Charter
GRAY, A. E., 416 E. 14th St., Oklahoma City, Okla..... 1924
GREEN, DR. C. V., Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me..... 1932
GREEN, PROF. GEORGE R., 511 S. Atherton St., State College, Pa..... 1925
GREEN, HAROLD T., Academy of Natural Sciences, Philadelphia, Pa..... 1927
GREEN, HUBERT U., Mistamick Lodge, Dauphin, Manitoba, Canada..... 1931
*GREEN, MORRIS M., 39 South Wyoming Ave., Ardmore, Pa..... 1924
GREEN, DR. ROBERT G., 223 Millard Hall, University of Minnesota, Minneapolis, Minn..... 1933

GREENFIELD, RAY H., 124 Maple Ave., Takoma Park, Md. 1928
GREGORY, S. S., JR., Box N., Winnetka, Ill. 1927
*GREGORY, TAPPAN, 19 S. La Salle St., Chicago, Ill. 1925
GREGORY, DR. WILLIAM K., American Museum of Natural History, New York City. . . . . Charter
GRIFFIN, DONALD, Barnstable, Mass. 1929
*GRINNELL, DR. GEORGE B., 238 E. 15th St., New York City. . . . . Charter
GRINNELL, DR. JOSEPH, Museum of Vertebrate Zoology, Berkeley, Calif. . . . . Charter
GRINNELL, MRS. JOSEPH, 3016 Benvenue Ave., Berkeley, Calif. 1923
GROSVENOR, DR. GILBERT, Hubbard Memorial Hall, 16th & M. Sts., N.W., Washington, D. C. 1921
GUTHRIE, MISS MARY J., Lefevre Hall, University of Missouri, Columbia, Mo. 1930
GYGER, MISS MAY KATHARINE, Balch Hall, Cornell University, Ithaca, N. Y. 1934
GYLDENSTOLPE, COUNT NILS, Naturhistoriska Riksmuseum, Stockholm, 50, Sweden. . . . . Charter
HAGNER, DR. FRANCIS R., 1824 19th St., N.W., Washington, D. C. 1925
HALL, ELGIN R. S., Box 387, Kenora, Ontario, Canada. 1929
HALL, DR. EUGENE RAYMOND, Museum of Vertebrate Zoology, Berkeley, Calif. 1923
HALL, DR. F. GREGORY, Duke University, Durham, N. C. . . . . Charter
HALL, FRANK S., 6320 17th Ave., N.E., Seattle, Wash. . . . . Charter
HALLORAN, ARTHUR FRANKLIN, 2716 Belrose Ave., Berkeley, Calif. 1934
HAMILTON, DR. W. J., JR., Dept. of Zoology, Cornell University, Ithaca, N. Y. 1924
HANSON, DR. KARL B., U. S. Experimental Fur Farm, Saratoga Springs, N. Y. 1921
HARKIN, J. B., Department of the Interior, Ottawa, Canada. . . . . Charter
HARKINS, DANIEL J., Franklin Park Zoo, Grove Hall P. O., Boston, Mass. 1929
HARPER, DR. FRANCIS, 732 Yale Ave., Swarthmore, Pa. . . . . Charter
HARRIS, HARRY, 5234 Hermosa Ave., Eagle Rock, Calif. . . . . Charter
*HARRIS, WILLIAM P., JR., 15410 Windmill Point Drive, Grosse Pointe Park, Mich. . . . 1924
HARRISON, F. A., Dept. of Lands & Forests, Halifax, Nova Scotia, Canada. 1934
HARRISON, GEORGE L., 1520 Locust St., Philadelphia, Pa. . . . . Charter
HARRISON, THOMAS, Box 4, Spiceland, Ind. 1930
HARROWER, DAVID E., 135 Elm St., Woodmere, L. I., N. Y. 1932
HART, CECIL, 132 N. Third St., Montebello, Calif. 1925
HARTER, SAMUEL G., Natural History Museum, Balboa Park, San Diego, Calif. 1928
HARTMAN, PROF. CARL G., Carnegie Laboratory of Embryology, Johns Hopkins Medical School, Baltimore, Md. 1921
HARWELL, C. A., Yosemite Museum, Yosemite National Park, Calif. 1927
HARWOOD, P. LE ROY, The Mariners Savings Bank, New London, Conn. 1932
HASKIN, NAGEL, 22 East Bradley Lane, Chevy Chase, Md. 1926
HATFIELD, DONALD M., Museum of Vertebrate Zoology, Berkeley, Calif. 1933
HATT, DR. ROBERT T., American Museum of Natural History, New York City. 1921
HAVEN, HERBERT M. W., 500 Forest Ave., Portland, Me. . . . . Charter
HAYNE, DON, 567 Bedford Road, Pocantico Hills, N. Y. 1933
HECK, PROF. DR. LUDWIG, Budapesterstr. 9, Berlin W. 62, Germany. 1928
HEILNER, VAN CAMPEN, Spring Lake Beach, N. J. 1928
HEIM DE BALSAC, H., 34 Rue Hamelin, Paris, 16e, France. 1928
HELLER, EDMUND, Zoological Garden, 4600 Vliet St., Milwaukee, Wis. . . . . Charter
HELLMAN, DR. MILO, 57 W. 57th St., New York City. 1921
HELME, ARTHUR H., Brooklyn Museum, Brooklyn, N. Y. . . . . Charter
HELMUTH, DR. WILLIAM TOD 3RD, 667 Madison Avenue, New York City. 1932
HENDERSON, WALTER C., 8 Magnolia Parkway, Chevy Chase, Md. . . . . Charter
HENN, DR. ARTHUR W., Carnegie Museum, Pittsburgh, Pa. 1930

HEPTNER, DR. VLADIMIR G., Zoological Museum of the University, 6 Gerzena St., Moscow 9, U. S. S. R. 1932
HERING, PAUL E., 408 Dryden Road, Ithaca, N. Y. 1930
HERFICH, FRED C., Peabody Museum, Yale Univ., New Haven, Conn. 1930
HERRICK, HAROLD, 141 Broadway, New York City 1926
HERSHKOVITZ, PHILIP, 6820 Thomas Blvd., Pittsburgh, Pa. 1932
HERZOG, DR. DIETRICH, Von Der Tannstrasse 13/0, Munchen, 2 NO, Germany 1931
HIBBARD, CLAUDE W., c/o Emergency Conservation Office, Mammoth Cave, Ky. 1932
HICKIE, PAUL F., Dept. of Conservation, Game Division, Lansing, Mich. 1931
HIGBEE, HARRY G., Hill-top Haven (Moose Hill Road), Sharon, Mass. 1930
HILL, JOHN E., Room 2593, Life Sciences Bldg., University of California, Berkeley, Calif. 1930
HILZHEIMER, DR. MAX, Wallstr. 52/54, Markisches Museum, Berlin S-14, Germany 1925
HINTON, MARTIN A. C., British Museum (Natural History) London, S.W. 7, England 1930
HISAW, PROF. FREDERICK L., Biology Bldg., University of Wisconsin, Madison, Wis. ..... Charter
HIXON, GEORGE C., c/o A. G. Paul, Watertown, Fla. 1930
HODGES, CHARLES H., JR., 59 Kenwood Road, Grosse Pointe Farms, Mich. 1927
*HODGES, WETMORE, Beverly Farms, Mass. 1927
HOEPKE, PROF. HERMANN, Anatomie, Heidelberg, Germany 1932
HOLLISTER, MRS. MABEL P., 1819 Ontario Place, N.W., Washington, D. C. 1925
HOLMAN, JOHN P., Fairfield, Conn. 1921
HOLT, ERNEST G., U. S. Erosion Service, La Crosse, Wis. ..... Charter
HONE, MISS ELISABETH B., Lyons Falls, Lewis Co., N. Y. 1933
HOOPER, EMMET T., Museum of Vertebrate Zoology, University of Calif., Berkeley, Calif. 1934
HOPE, CLIFFORD E., Royal Ontario Museum of Zoology, 100 Queen's Park, Toronto, Ontario, Canada 1931
HOPWOOD, A. T., Dept. Geology, British Museum (Natural History), London, S.W. 7, England 1930
HORNADAY, DR. WILLIAM T., 1 Bank St., Stamford, Conn. ..... Charter
HORNE, I. S., 505 Atlanta St., Altadena, Calif. 1923
HÓRRING, H., Mag. Scient., Zoologisk Museum, Copenhagen, Denmark 1924
HORSFALL, R. BRUCE, c/o American Nature Association, 1214 16th St., Washington, D. C. ..... Charter
HOSLETT, SHERMAN A., Luther College, Decorah, Iowa 1932
HOSLEY, NEIL W., 812 Pauline Blvd., Ann Arbor, Mich. 1933
HOUSE, E. J., 57 Fidelity Bldg., Pittsburgh, Pa. 1926
HOVERSON, JULIUS, Centralia Junior College, Centralia, Wash. 1934
HOWARD, JOHN K., 55 Congress St., Boston, Mass. 1928
HOWARTH, FRED J., P. O. Drawer, 570, Raton, New Mexico 1931
*HOWELL, PROF. A. BRAZIER, Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md. ..... Charter
HOWELL, ARTHUR H., 2919 South Dakota Ave., Washington, D. C. ..... Charter
HOY, DR. WILLIAM E., JR., Dept. of Biology, University of South Carolina, Columbia, S. C. 1922
HUBBACK, THEODORE R., Sunlaws, Bukit Betong, Kuala Lipis, Pahang, Federated Malay States 1922
HUBER, DR. G. CARL, 1330 Hill St., Ann Arbor, Mich. 1927
HUBER, WHARTON, Academy of Natural Sciences, Philadelphia, Pa. 1922

HUESTIS, DR. R. R., Dept. of Zoology, University of Oregon, Eugene, Ore..... 1927
HUEY, LAURENCE M., Museum of Natural History, Balboa Park, San Diego, Calif.....Charter
HUGHES, GEORGE T., Box 153, Plainfield, N. J..... 1926
HUNGATE, PROF. J. W., State Normal School, Cheney, Wash..... 1925
JACKSON, PROF. C. F., Dept. of Zoology, University of New Hampshire, Durham, N. H..... 1921
*JACKSON, DR. HARTLEY H. T., U. S. Biological Survey, Washington, D. C...Charter
JACKSON, MRS. HARTLEY H. T., 6313 Ridgewood Ave., Chevy Chase, Md....Charter
JACKSON, RALPH W., Route 1, Cambridge, Md..... 1921
JACOBI, PROF. DR. ARNOLD, Museum fur Tierkunde, Dresden 1, Germany..... 1930
JACOT, E. C., Route 2—Box 224, Tucson, Ariz..... 1921
JAEGER, EDMUND C., 4462 6th St., Riverside, Calif..... 1921
JAMES, NORMAN, The James Lumber Company, Baltimore, Md.....Charter
JELLISON, WILLIAM L., Hamilton, Mont..... 1931
JENKS, RANDOLPH, Mount Kemble, Morristown, N. J..... 1932
JEPSEN, GLENN L., Dept. of Geology, Princeton University, Princeton, N. J..... 1930
JEWETT, STANLEY G., 1404 Bidwell Ave., Portland, Ore.....Charter
JOHNSON, DR. ARTHUR M., Dept. of Biology, University of California, Los Angeles, Calif..... 1923
JOHNSON, PROF. CHARLES E., State College of Forestry, Syracuse, N. Y.....Charter
JOHNSON, DAVID H., P. O. Box 817, Weed, Calif..... 1933
JOHNSON, FRANK W., 2020 South 27th St., Lincoln, Neb..... 1931
JOHNSON, PROF. GEORGE E., Dept. of Zoology, Kansas State College, Manhattan, Kansas.....Charter
JOHNSON, JULIUS M., 293 S. Pleasant Ave., Ridgewood, N. J..... 1924
JOHNSON, DR. MAYNARD S., 26 Summer St., Saugus, Mass..... 1923
JOHNSON, DR. PAUL B., 3208 17th St., N.W., Washington, D. C..... 1924
JONES, GORDON W., "Elwood," Wilderness, Va..... 1934
JONES, S. PAUL, 509 West Ave., North, Waukesha, Wis..... 1929
JOSEPH, ELLIS S., 179 Mosholu Parkway, North, New York City..... 1923
KALMBACH, E. R., U. S. Biological Survey, 2654 Forest St., Denver, Col..... 1925
KASHKAROV, DR. D., Department of Ecology, University of Leningrad, Leningrad, U. S. S. R..... 1929
KEAYS, J E., 328 St. George St., London, Ontario, Canada..... 1924
KELKER, GEORGE H., R. D. 3, Garrettsville, Ohio..... 1932
KELLOGG, JOHN P., 231 S. La Salle St., Chicago, Ill..... 1934
KELLOGG, DR. A. REMINGTON, U. S. National Museum, Washington, D. C.....Charter
*KENNARD, FREDERIC H., Dudley Road, Newton Centre, Mass..... 1921
KIDDER, NATHANIEL T., Milton, Mass..... 1921
KING, DR. BENJAMIN H., 1215 Lake Shore Drive, Coeur d'Alene, Idaho..... 1922
KING, DR. HELEN D., 17 Elliot Ave., Bryn Mawr, Pa..... 1930
*KIRKHAM, PROF. WILLIAM B., 275 Maple St., Springfield, Mass.....Charter
KIRKWOOD, FRANK C., Phoenix, Baltimore Co., Md.....Charter
*KIRN, ALBERT J. B., Box 157, Somerset, Tex..... 1922
KNAPPEN, MISS PHOEBE M., U. S. Biological Survey, Washington, D. C..... 1928
KOOKER, T. H., Realty Bldg., Jacksonville, Fla..... 1925
KRAUSS, N. H., 2557 Parker Place, Honolulu, Hawaii..... 1929
KRUMKE, KARL E., JR., 6711 2nd St., N.W., Washington, D. C..... 1934
KUNKEL, KENNETH M., Room 124, State House, Indianapolis, Ind..... 1933
KURODA, DR. NAGAMICHI, Fukuyoshi Cho, Akasaka, Tokyo, Japan.....Charter
*LADD, DR. WILLIAM S., 254th St. & Independence Ave., New York City..... 1922

La Due, Harry J., St. Peter, Minn. 1927
Landberg, Robert L., Colorado Museum of Natural History, City Park, Denver, Col. 1927
Landwer, M. Frederic, Biology Dept., Texas Technical College, Lubbock, Tex. 1933
Lane, Dr. H. H., Dept. of Zoology, University of Kansas, Lawrence, Kansas. Charter
Lane, H. Wallace, Dyche Museum, Lawrence, Kansas. 1930
*Lang, Herbert, American Museum of Natural History, New York City. Charter
Langstroth, James H., P.O. Bin D, Silver City, N. Mex. 1926
Langworthy, Dr. O. R., Johns Hopkins Hospital, Baltimore, Md. 1928
Larrabee, Prof. Austin P., Yankton College, Yankton, S. D. 1921
Laurence, Miss Barbara, Museum of Comparative Zoology, Cambridge, Mass. 1933
La Voy, Merl, Explorers Club, 2 West 72nd St., New York City. 1930
Lawlor, William Keys Andrew, State Museum, Albany, N. Y. 1933
Leeds, Arthur N., 5321 Baynton St., Germantown, Philadelphia, Pa. 1931
*Leighton, Alexander H., Corpus Christi College, Cambridge, England. 1924
Leister, Dr. C. W., New York Zoological Park, Bronx, New York City. Charter
Leopold, Aldo, Soils Bldg., University of Wisconsin, Madison, Wis. Charter
Leraas, Harold J., Museum of Zoology, Ann Arbor, Mich. 1932
Lewis, John B., P.O. Box 86, Amelia, Va. 1926
Lewis, Merriam G., Salem, Va. 1926
Lewis, Dr. Nolan D. C., St. Elizabeth's Hospital, Washington, D. C. 1927
Licking, Clyde, Rosebud, S. D. 1931
Ligon, J. Stokley, Box 667, Carlsbad, New Mex. Charter
Lincoln, Frederick C., U. S. Biological Survey, Washington, D. C. Charter
Linsdale, Dr. Jean M., Museum of Vertebrate Zoology, Berkeley, Calif. 1921
Little, Dr. Clarence C., Bar Harbor, Maine. 1927
Little, Luther, 1400 Wayne Ave., South Pasadena, Calif. Charter
Lloyd, Hoyes, 582 Mariposa Ave., Rockliffe Park, Ottawa, Ontario, Canada. Charter
Locke, S. B., Isaac Walton League, 222 N. Bank Drive, Chicago, Ill. 1923
Lönnberg, Dr. Einar, Naturhistoriska Riksmuseum, Vetenskapsakademien, Stockholm, 50, Sweden. Charter
Loomis, Prof. F. B., 8 Orchard St., Amherst, Mass. 1926
Loring, John Alden, Owego, Tioga County, N. Y. Charter
Lovell, Prof. Harvey B., Belknap Campus, University of Louisville, Louisville, Ky. 1934
Lowe, Prof. John N., Normal College, Marquette, Mich. 1925
Lubicz-Niezabitowski, Prof. Dr. Edward, Uniwersytet Ul. Fredry 10, Posnan, Poland. 1933
Luttringer, Leo A., Jr., Board of Game Commissioners, Harrisburg, Pa. 1932
*Lyman, Prof. Theodore, Harvard University, Cambridge, Mass. 1921
*Lyon, Dr. M. W., Jr., 122 North Lafayette Boulevard, South Bend, Ind. Charter
Lyon, William I., 811 North Sheridan Road, Waukegan, Ill. 1925
MacCoy, Clinton V., 1213 Beacon St., Brookline, Mass. 1930
Macko, Harry A., 1765, Lockwood Drive, East Cleveland, Ohio. 1923
Maclulich, Duncan A., Royal Ontario Museum of Zoology, Queen's Park at Bloor St., Toronto 5, Ontario, Canada. 1933
Macnamara, Charles, Arnprior, Ontario, Canada. 1927
Madison, Harold L., Cleveland Museum of Natural History, Cleveland, Ohio. Charter
Mailliard, Joseph, 1815 Vallejo St., San Francisco, Calif. Charter
Malkin, Leon B., U. S. Biological Survey, Washington, D. C. 1932
*Mann, Dr. William M., National Zoological Park, Washington, D. C. 1926

MARCOTTE, L'ABBE LEON, Seminaire St. Charles, Sherbrooke, Quebec, Canada. 1925
MARDEN, AARON, Eagle Island, South Harpswell, Me. 1926
MATHER, DEANE W., 949 Maple Ave., Ridgefield, N. J. 1930
McBLAIN, WALTER G., U. S. Fur Animal Experiment Station, Saratoga, N. Y.. 1930
McCABE, THOMAS T., Museum Vertebrate Zoology, Berkeley, Calif. 1928
McCLINTOCK, NORMAN, c/o Rutgers University, New Brunswick, N. J. Charter
McGREGOR, PROF. JAMES H., Columbia University, New York City. 1927
McGREW, PAUL O., 533 N. 27th St., Lincoln, Neb. 1931
McILHENNY, EDWARD A., Avery Island, La. Charter
McLAIN, ROBERT B., P. O. Box 132, Hollywood Station, Los Angeles, Calif.. Charter
McLAUGHLIN, DONALD T., Lassen Union High School, Susanville, Calif. 1931
McNAIR, MRS. RUTH K., 1624 Alabama St., Lawrence, Kansas. 1932
MERRIAM, DR. JOHN C., Carnegie Institution of Washington, Washington, D. C. Charter
MESSER, HAROLD M., 6 Adele Place, Baldwin, N. Y. 1926
METCALF, PROF. Z. P., North Carolina State College, Raleigh, N. C. Charter
MIDDLETON, DR. AUSTIN R., Biological Laboratories, University of Louisville, Louisville, Ky. 1921
MILLER, DR. ALDEN H., Museum of Vertebrate Zoology, Berkeley, Calif. 1930
MILLER, FREDERIC W., Colorado Museum of Natural History, City Park, Denver, Col. 1921
MILLER, GERRIT S., JR., U. S. National Museum, Washington, D. C. Charter
MILLER, DR. LOYE H., University of California at Los Angeles, Los Angeles, Calif. Charter
MILLER, PROF. SHIRLEY P., Institute of Anatomy, University of Minnesota, Minneapolis, Minn. Charter
MIRGUET, JOSEPH C., 449 Magnolia St., Rochester, N. Y. 1928
MOFFITT, JAMES, 1879 Broadway, San Francisco, Calif. 1929
MOHR, CARL OTTO, Natural History Survey, Urbana, Ill. 1927
MOHR, CHARLES E., 815 Greenwich St., Reading, Pa. 1932
MOHR, MISS ERNA W., Zoologische Museum, Hamburg, Germany. 1928
MOODY, DR. PAUL A., Williams Science Hall, Burlington, Vt. 1923
MOORE, A. W., 1671 Main St., Hillsboro, Ore. 1921
MOORE, ROBERT T., R.R. 1., Box 28A., Pasadena, Calif. 1926
MORAND, FLORIAN W., (Address lost). 1931
MORDEN, WILLIAM J., American Museum of Natural History, New York City. 1925
MORI, TAMEZO, Preparatory Dept., Keijo Imperial University, Seoul, Korea. 1927
MOSELEY, PROF. E. L., State College, Bowling Green, Ohio. Charter
MURIE, DR. ADOLPH, Museum of Zoology, Ann Arbor, Mich. 1924
MURIE, OLAUS J., Jackson, Wyo. Charter
NAGEL, JOHN K., 855 Humboldt St., Denver, Col. 1932
NAUMBURG, MRS. WALTER H., Davis Farm, New Canaan, Conn. 1922
NELSON, ARNOLD L., U. S. Biological Survey, Washington, D. C. 1932
NELSON, THEODORA, Hunter College Annex, 145 E. 32nd St., New York City. 1929
NETTING, M. GRAHAM, Carnegie Museum, Pittsburgh, Pa. 1934
NEWSOM, WILLIAM M., 228 E. 61st St., New York City. 1926
NICHOLS, JOHN TREADWELL, American Museum of Natural History, New York City. Charter
NOBACK, DR. CHARLES V., New York Zoological Park, Bronx, New York City. 1929
NOBLE, DR. G. K., American Museum of Natural History, New York City. 1926
NOBLE, HOWARD, 101 Tremont St., Boston, Mass. 1930
NORTON, ARTHUR H., Museum of Natural History, Portland, Me. Charter

ODERKIRK, GALEN C., Dept. of Entomology, Purdue Iniversity, Lafayette, Ind.... 1927
O'DONOGHUE, PROF. CHAS. H., Dept. of Zoology, University of Edinburgh, Edinburgh, Scotland.....Charter
OEHSER, PAUL H., Smithsonian Institution, Washington, D. C..... 1926
OGNEV, DR. S. I., University Zoological Museum, Moscow, U. S. S. R..... 1924
OKKELBERG, PROF. PETER, 1220 Fair Oaks, Ann Arbor, Mich.....Charter
ORR, ROBERT T., 759 31st Ave., San Francisco, Calif..... 1931
OSBORN, CHASE S., Poulan, Worth County, Ga..... 1925
OSGOOD, FREDERICK L., JR., 17 Charles St., Rutland, Vt..... 1933
*OSGOOD, DR. WILFRED H., Field Museum of Natural History, Chicago, Ill.....Charter
OSTENSON, BURTON T., Museum of Zoology, Ann Arbor, Mich..... 1933
OWEN, KEITH, Davis Gardens, P. O. Box 783, Terre Haute, Ind..... 1933
PACK, ARTHUR N., 11 Morven St., Princeton, N. J..... 1929
PALMER, DR. E. LAURENCE, Fernow Hall, Ithaca, N. Y..... 1927
PALMER, L. J., Reindeer Experiment Station, College, Alaska..... 1927
PALMER, DR. T. S., 1939 Biltmore St., N.W., Washington, D. C.....Charter
PARKER, DR. GEORGE H., 16 Berkeley St., Cambridge, Mass.....Charter
PARKER, HARRY C., Museum of Natural History, Worcester, Mass..... 1927
PARKER, WESLEY, D., Sullys Hill National Park Game Preserve, Ft. Totten, N. Dak..... 1926
PARNELL, DR. IVAN W., Box 254, Mac Donald College P. O., Prov. of Quebec, Canada..... 1933
PATTERSON, BRYAN, Field Museum of Natural History, Chicago, Ill..... 1929
PEARCE, JOHN, New York State College of Forestry, Syracuse, N. Y..... 1931
PEARSON, DR. T. GILBERT, 1775 Broadway, New York City.....Charter
PERKINS, PROF. E. H., Colby College, Waterville, Me..... 1922
PETERS, JAMES L., Lane End, Harvard, Mass.....Charter
PHILLIPS, FRANK, Route 4, F.P. Ranch, Bartlesville, Okla..... 1926
*PHILLIPS, DR. JOHN C., Wenham, Mass.....Charter
PHILLIPS, JOHN M., 2227 Jane St., Pittsburgh, Pa.....Charter
PHILLIPS, MAURICE E., Hanshaw Road, R. 1., Ithaca, N. Y..... 1928
PICKWELL, GAYLE B., State Teachers College, San Jose, Calif..... 1926
PIERCE, WRIGHT M., Box 343, Claremont, Calif..... 1926
PIERSON, PROF. CHARLES J., 16 Ravenswood Ave., Hyattsville, Md.....Charter
PING, DR. CHI, Biological Laboratory, Science Society of China, Nanking, China.. 1931
PIRNIE, DR. MILES D., W. K. Kellogg Bird Sanctuary, Augusta, Mich..... 1928
POHLE, DR. HERMANN, Zoologisches Museum, Invalidenstrasse 43, Berlin, N. 4, Germany..... 1928
POOLE, ARTHUR J., Room 51, U. S. National Museum, Washington, D. C.....Charter
POOLE, E. L., Reading Public Museum, Reading, Pa..... 1922
*POPE, GUSTAVUS D., 1020 Ford Bldg., Detroit, Mich..... 1924
PORRO, THOMAS J., 718 Medical Arts Bldg., Tacoma, Wash..... 1931
POUGH, RICHARD H., Alden Park Manor, Germantown, Philadelphia, Pa..... 1927
*PRATT, HON. GEORGE D., 26 Broadway, New York City.....Charter
PREBLE, EDWARD A., U. S. Biological Survey, Washington, D. C.....Charter
PRICE, DR. EMMETT W., 3718 R. St., N.W., Washington, D. C..... 1930
RADCLIFFE, LEWIS, 5600 32nd St., N.W., Washington, D. C..... 1930
RAMSDEN, DR. CHARLES T., P. O. Box 146, Guantánamo, Cuba.....Charter
RAND, DR. A. L., Wolfville, Nova Scotia, Canada..... 1933
RAVEN, HARRY C., American Museum of Natural History, New York City...Charter
RAYNES, GEORGE W., 209 Miller Ave., Portsmouth, N. H..... 1922

REED, SHELDON C., Bussey Institution, Harvard University, Jamaica Plain, Mass. 1934
REEVES, MARK W., Stockade, Clinton, Conn. 1928
REHN, JAMES A. G., Academy of Natural Sciences, Philadelphia, Pa. Charter
RICHARDSON, WILLIAM B., Route 2, Box 1170, Porterville, Calif. 1933
RICHTER, DR. CURT P., Psychological Laboratory, Johns Hopkins Hospital, Baltimore, Md. 1924
RIDSDALE, P. S., 1214–16th St., N.W., Washington, D. C. 1926
RIEMER, JULIUS, Berlinerstr. 163, Berlin-Tempelhof, Germany. 1930
RILEY, J. H., U. S. National Museum, Washington, D. C. Charter
RILEY, SMITH, 2340 Ivanhoe St., Denver, Col. 1921
*RINDSFOOS, WILLIAM, Brunson Bldg., Columbus, Ohio. Charter
RITTER, DR. WILLIAM E., Dept. of Zoology, University of Calif., Berkeley, Calif. 1926
ROBERTS, AUSTIN, Transvaal Museum, Pretoria, South Africa. Charter
ROBERTS, H. RADCLYFFE, Villa Nova, Pa. 1925
ROBERTS, DR. T. S., Zoological Museum, University of Minnesota, Minneapolis, Minn. Charter
ROBERTSON, HOWARD, 157 Wilton Drive, Los Angeles, Calif. Charter
ROBINSON, JAMES B., c/o Rear Admiral S. M. Robinson, Navy Dept., Washington, D. C. 1923
ROBINSON, HON. T. DOUGLAS, Mohawk, N. Y. 1924
ROFF, WILLIAM W., 1741 Calumet Ave., Detroit, Mich. 1930
ROGERS, ALBERT C., Colorado Museum of Natural History, City Park, Denver, Col. Charter
*ROGERS, CHARLES H., Museum of Zoology, Princeton, N. J. Charter
ROOSEVELT, KERMIT, 1 Broadway, New York City. Charter
ROOSEVELET, THEODORE, JR., Oyster Bay, Long Island, N. Y. 1925
ROPSHAW, DR. H. J., 1291 E. Boulevard, Cleveland, Ohio. 1923
ROSE, ROBERT H., Southwestern National Monuments, Coolidge, Arizona. 1933
ROSS, ETTA L., 1820 Bushnell Ave., South Pasadena, Calif. 1927
*ROTHSCHILD, LORD LIONEL WALTER, Zoological Museum, Tring, Herts, England. Charter
ROWAN, PROF. WILLIAM, University of Alberta, Edmonton, Alberta, Canada. 1921
ROWLAND, CLAUDE ROGER, Box 44, Schermerhorn Hall, Columbia University, New York City. 1933
ROWLEY, J. STUART, 1821 South Monterey St., Alhambra, Calif. 1928
RUHL, H. D., Game Division, Conservation Dept., Lansing, Mich. 1928
RUHLE, GEORGE C., Glacier National Park, Belton, Mont. 1933
RUHE, DR. HERMANN, Kalandstr., Alfeld (Leine), Germany. 1930
RUSCONI, CARLOS, Garay 3818, Buenos Aires, Argentina. 1933
RUSH, W. M., c/o U. S. Forest Service, Missoula, Mont. 1925
RUSSELL, C. P., U. S. National Park Service, University of California, Berkeley, Calif. 1931
RUSSELL, WARD C., Museum of Vertebrate Zoology, Berkeley, Calif. 1930
RUST, HENRY J., Box 683, Coeur d'Alene, Idaho. 1922
SAGE, DEANE, JR., Bernardsville, N. J. 1933
SANBORN, COLIN C., Field Museum of Natural History, Chicago, Ill. 1924
SANDERSON, WILFORD E., 80 Howard St., Albany, N. Y. 1927
SANS, EDWARD R., Box 805, Reno, Nev. Charter
SANTENS, R. H., Carnegie Museum, Pittsburgh, Pa. 1934

SAUNDERS, W. E., London, Ontario, Canada.....Charter
SAVIN, WILLIAM M., 40 Wall St., New York City..... 1925
SAYLES, E. DUANE, Virginia Junior College, Virginia, Minn..... 1931
*SCALON, W. W., In care of, Madame Sofie N. Scalon, Troudowaja 6, Nowosibirsk, Siberia, U. S. S. R..... 1927
SCHAUENSEE, RUDOLPH MEYER DE, Devon, Pa..... 1931
SCHEAR, PROF. E. W. E., 107 West Park St., Westerville, Ohio..... 1922
SCHEFFER, THEOPHILUS H., Puyallup, Wash.....Charter
SCHLAIKJER, ERICH M., Dept. Geology, Brooklyn College, Brooklyn, N. Y..... 1931
SCHMIDT, F. J. W., Stanley, Wis..... 1927
SCHMIDT, KARL P., Field Museum of Natural History, Chicago, Ill..... 1925
SCHMITT, DR. WALDO L., U. S. National Museum, Washington, D. C.....Charter
SCHNELL, FRANK, JR., Box 188, Columbus, Ga..... 1934
SCHOONMAKER, WALTER J., State Museum, Albany, N. Y..... 1924
SCHORGER, A. W., 168 North Prospect Ave., Madison, Wis..... 1924
SCHULTZ, DR. ADOLPH H., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md.....Charter
SCHULTZ, DR. C. BERTRAND, Nebraska State Museum, Univ. of Nebraska, Lincoln, Neb..... 1933
SCHULTZ, EDITH C., 676 Riverside Drive, New York City..... 1930
SCHURR, BURLINGHAM, Naturalist-on-the Mountain, Granby, Mass..... 1929
SCHWARZ, MAX D., 625 Tuxedo Boulevard, Webster Groves, Mo..... 1934
SCOTT, PROF. JOHN W., University of Wyoming, Laramie, Wyo..... 1925
SCOTT, WALTER J., Swarthmore College, Swarthmore, Pa..... 1933
SCOTT, PROF. WILLIAM BERRYMAN, 7 Cleveland Lane, Princeton, N. J..... 1934
SEFTON, JOSEPH W., JR., 638 F St., San Diego, Calif..... 1925
SELBIE, WILLIAM E., 315 South Lincoln St., Glendale, Calif..... 1933
SELLE, RAYMOND M., Occidental College, Los Angeles, Calif..... 1928
*SETON, ERNEST THOMPSON, Seton Village, Santa Fe, N. Mex.....Charter
SETON, HENRY W., 7 West 52nd St., New York City..... 1924
SHADLE, PROF. ALBERT R., University of Buffalo, Buffalo, N. Y..... 1925
SHAMEL, H. HAROLD, U. S. National Museum, Washington, D. C..... 1923
SHAW, DR. WILLIAM T., 1002 Cambridge Ave., Fresno, Calif.....Charter
SHEARER, DR. AMON R., Mont Belvieu, Chambers Co., Tex..... 1923
SHELDON, MISS CAROLYN, 513 Oswego St., Ann Arbor, Mich..... 1930
SHELDON, H. H., 520-B., East Arrelaga, Santa Barbara, Calif.....Charter
SHELDON, COL. H. P., U. S. Biological Survey, Washington, D. C..... 1928
SHELDON, WILLIAM G., 196 School St., Milton, Mass..... 1933
SHELFORD, DR. VICTOR E., Vivarium Bldg., Champaign, Ill..... 1923
SHEPPARD, WALTER P., 1060 Gaylord St., Denver, Col..... 1929
*SHERMAN, MISS ALTHEA R., National, via McGregor, Iowa.....Charter
SHERMAN, PROF. HARLEY B., R. F. D. 2, Gainesville, Fla.....Charter
SHILLINGER, DR. J. E., U. S. Biological Survey, Washington, D. C..... 1930
*SHIRAS, GEORGE 3RD, 4530 Klingle St., N.W., Washington, D. C.....Charter
SHOEMAKER, CARL D., 3700 Massachusetts Ave., N.W., Washington, D. C..... 1932
SHOEMAKER, CLARENCE R., U. S. National Museum, Washington, D. C.....Charter
SHOEMAKER, COL. HENRY W., American Legation, Sofia, Bulgaria.....Charter
SILLIMAN, O. P., Cor. Alisal and Riker Sts., Salinas, Calif..... 1924
SILVER, JAMES, U. S. Biological Survey, Washington, D. C.....Charter
SIMPSON, DR. GEORGE G., American Museum of Natural History, New York City..... 1928
SINCLAIR, DR. WILLIAM J., 154 Prospect Ave., Princeton, N. J..... 1923

Skillen, Dr. Donald R., Route 1, Box 65, Pasadena, Calif. 1933
Skinner, M. P., 1316 Harding St., Long Beach, Calif. Charter
Smiley, Albert K., Jr., Mohonk Lake, N. Y. 1932
Smiley, Daniel, Jr., Mohonk Lake, N. Y. 1933
Smith, Austin Paul, Apartado 412, San Jose, Costa Rica. Charter
Smith, Horace G., 2918 Lafayette St., Denver, Col. Charter
Smith, Wendell P., Wells River, Vt. 1927
Snyder, L. L., Royal Ontario Museum of Zoology, Toronto, Ontario, Canada. 1921
Snyder, Mrs. Viola S., 4702 Hunt Ave., Chevy Chase, Md. Charter
Soper, J. Dewey, 460 Telfer St., Winnipeg, Manitoba, Canada. Charter
Sowerby, Arthur de C., 20 Museum Road, Shanghai, China. Charter
Spalding, Irwin, P. O. Box 2787, Honolulu, T. H. 1928
Spaulding, Prof. M. Herrick, 507 So. 8th Ave., Bozeman, Mont. Charter
Spencer, Donald A., 527 Customhouse Bldg., Denver, Colo. 1928
Sperry, Prof. Arthur B., Kansas Agricultural College, Manhattan, Kansas. 1923
Sperry, Charles C., 1455 So. Franklin St., Denver, Col. Charter
Stanford, J. S., Utah State Agricultural College, Logan, Utah. 1931
Stark, W. P., 1789 Rockland Ave., Victoria, British Columbia. Charter
Stebler, Adolph M., Museum of Zoology, Ann Arbor, Mich. 1933
Steenberg, Prof. Dr. Carl M., Silene Alle 9, Copenhagen Soeborg, Denmark. 1929
Stegeman, Leroy C., New York State College Forestry, Syracuse, N. Y. 1929
Stein, Charles F., Jr., 231 St. Paul St., Baltimore, Md. 1926
Stephens, Frank, 3746 Park Blvd., San Diego, Calif. Charter
Stewart, Phillip B., Hotel El Encanto, Santa Barbara, Calif. 1921
Stichel, Dr. W., Königstr. 22, Leipzig C1, Germany. 1929
Stiles, Dr. C. W., Room 302, U. S. National Museum, Washington, D. C. 1928
Stirton, R. A., Museum of Paleontology, Berkeley, Calif. 1923
Stock, Dr. Chester, California Institute Technology, Pasadena, Calif. Charter
Stoddard, Herbert L., The Hall, Route 1, Tallahassee, Fla. Charter
Stone, Dwight D., Route 1, Casa Grande, Ariz. Charter
Stone, Harry H., P. O. Box 101, Sturbridge, Mass. 1926
Stone, Dr. Witmer, Academy of Natural Sciences, Philadelphia, Pa. Charter
Stoner, Dr. Dayton, New York State Museum, Albany, N. Y. Charter
Storer, Prof. Tracy I., Division of Zoology, University of California, Davis, Calif. Charter
Stout, Thompson M., Morrill Hall, Nebraska State Museum, Lincoln, Nebr. 1934
Straus, Dr. William L., Jr., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md. 1925
Stray, Joseph W., 134–136 Broadway, Brooklyn, N. Y. 1924
Streator, Clark P., 16 Mason St., Santa Cruz, Calif. Charter
Strong, Dr. Wm. Duncan, Bureau of American Ethnology, Smithsonian Institution, Washington, D. C. 1931
Strong, William M., (Address lost). 1932
Strunk, W. L., Luther College, Decorah, Iowa. 1929
Stuart, Edward T., Jr., 205 Glenn Road, Ardmore, Pa. 1926
Sturgis, R. S., (Address lost). 1933
Sturtevant, Maj. C. G., 4708 Abbott Ave., Dallas, Tex. 1923
Sumner, E. L., Jr., Museum of Vertebrate Zoology, Berkeley, Calif. 1926
Sumner, Dr. Francis B., Scripps Institution, La Jolla, Calif. Charter
Surber, Thaddeus, 1539 Dayton Ave., St. Paul, Minn. 1925
Svihla, Dr. Arthur, Zoology Dept., State College, Pullman, Wash. 1926
Svihla, Mrs. Ruth D., Zoology Dept., State College, Pullman, Wash. 1927

SWARTH, HARRY S., California Academy of Sciences, San Francisco, Calif.....Charter
SWENK, PROF. MYRON H., 1410 N. 37th St., Lincoln, Nebraska.....Charter
SWINDLE, DR. PERCY F., 561 N. 15th St., Milwaukee, Wis..... 1927
TANNER, PROF. VASCO M., Brigham Young University, Provo, Utah.....Charter
TATE, GEORGE H. H., American Museum Natural History, New York City..... 1924
TAYLOR, DR. EDWARD H., Dept. Zoology, University of Kansas, Lawrence, Kansas..... 1924
TAYLOR, DR. WALTER P., 1746 East 5th St., Tucson, Ariz.....Charter
TEACHENOR, DIX, Kansas City Life Insurance Co., Armour and Broadway, Kansas City, Mo..... 1920
TERHUNE, HUGH W., Box 2021, Juneau, Alaska..... 1928
TEST, FREDERICK H., 511 Russell St., West Lafayette, Ind..... 1930
THOMPSON, HARTLEY, Westmoreland, N. Y..... 1921
THONE, DR. FRANK T., Science Service, Washington, D. C..... 1932
THORPE, DR. MALCOLM R., Peabody Museum of Natural History, Yale University, New Haven, Conn..... 1921
TINKLEPAUGH, DR. OTTO L., 333 Cedar St., New Haven, Conn..... 1928
TODD, DR. T. WINGATE, Western Reserve Medical School, Cleveland, Ohio.....Charter
TOKUTA, MITOSHI, c/o Zoological Institute, College of Science, Kyoto Imperial University, Kyoto, Japan..... 1934
TOLL, ROGER W., Yellowstone National Park, Wyo..... 1930
TOMKINS, IVAN R., U. S. Dredge "Morgan," Savannah, Ga..... 1930
TOUT, WILSON, North Platte, Nebraska..... 1926
TOWNSEND, DR. CHARLES H., New York Aquarium, New York City..... 1930
TOWNSEND, PROF. M. T., Illinois Wesleyan Univ., Bloomington, Ill..... 1928
TROST, HENRY J., De Young Memorial Museum, San Francisco, Calif..... 1926
TUROV, PROF. S., Zoological Museum, Moscow University, Moscow 9, Herzen St. 6, U. S. S. R..... 1930
TYRRELL, W. BRYANT, Catonsville, Md..... 1929
TYSON, NATALIE E., Rose Lane, Haverford, Pa..... 1934
UHLER, FRANCIS M., U. S. Biological Survey, Washington, D. C..... 1926
VAN DEN BRINK, F. H., 19 Dillenburgstraat, Utrecht, Netherlands..... 1928
VAN TYNE, DR. JOSSELYN, University Museums, Ann Arbor, Mich..... 1924
VAN VLEET, GEORGE, JR., Dept. of Entomology, Cornell University, Ithaca, N. Y..... 1934
VERNAY, ARTHUR S., 51 Berkeley Square, London, England..... 1928
VERSLUYS, DR. JAN, Grinzingeralle 18, Wien 19, Austria..... 1930
VIJJAKICH, LUANG S., McGraw Hall, Cornell Univ., Ithaca, N. Y..... 1933
VON BLOEKER, JACK C., JR., Apt. 105, 4029 Oakwood Ave., Los Angeles, Calif..... 1927
VORHIES, DR. CHARLES T., University of Arizona, Tucson, Ariz.....Charter
VREELAND, FREDERICK K., 90 West St., New York City, N. Y.....Charter
VRTIŠ, DR. VLASTIMIL, Pražeská 69, Brno, Czechoslavakia..... 1932
WADE, PROF. OTIS, Bessey Hall, State University, Lincoln, Nebraska..... 1926
WAGNER, LAVERNE G., 36 Erie St., Lancaster, N. Y..... 1934
WAINWRIGHT, DR. J. M., Scranton, Pa..... 1927
*WALCOTT, HON. F. C., Norfolk, Conn.....Charter
WALKER, ALEXANDER, Route A., Box 267, Tillamook, Ore..... 1921
*WALKER, BRYANT, 1306 Dime Bank Bldg., Detroit, Mich..... 1924
WALKER, ERNEST P., Apt. 103, 3016 Tilden St., N.W., Washington, D. C.....Charter
WALTERS, LEON L., Field Museum of Natural History, Chicago, Ill.....Charter
WARMBATH, JULIAN S., U. S. National Museum, Washington, D. C.....Charter

WARREN, EDWARD R., 1511 Wood Ave., Colorado Springs, Col.....Charter
WARTHIN, PROF. ALFRED S., JR., Vassar College, Poughkeepsie, N. Y..... 1926
WAY, IVAN M., 809 Harrison St., Denver, Col..... 1926
WEBER, LOUIS, 4740 Mascher St., Philadelphia, Pa..... 1927
WEED, PROF. LEWIS H., Dept. of Anatomy, Johns Hopkins Medical School, Baltimore, Md..... 1921
WEEMS, F. CARRINGTON, 23 Wall St., New York City..... 1930
*WEHRHANE, HENRY H., 888 Park Ave., New York City..... 1924
WENDT, ROBERT H., 215 Stonewood Ave., Rochester, N. Y..... 1932
*WETMORE, DR. ALEXANDER, U. S. National Museum, Washington, D. C.....Charter
WEYDEMEYER, WINTON W., Fortine, Mont..... 1927
WHILTON, MISS YNEZ, Hotel Whilton, Hanford, Calif..... 1932
WHITAKER, H. L., Oktaha, Okla..... 1934
*WHITE, FRANCIS BEACH, Saint Pauls School, Concord, N. H.....Charter
WHITE, JAMES S., 6036 Kenmore Ave., Chicago, Ill..... 1931
WHITE, THEODORE E., Museum of Comparative Zoology, Cambridge, Mass..... 1926
WHITLOW, WAYNE B., (Address lost)..... 1929
WHITNEY, ALVIN G., New York State Museum, Albany, N. Y.....Charter
WHITNEY, LEON F., 185 Church St., New Haven, Conn..... 1931
WIGHT, PROF. H. M., 1417 S. University Ave., Ann Arbor, Mich..... 1921
WILDER, H. E., Carlotta, Humboldt Co., Calif.....Charter
WILLIAMS, COLEMAN S., American Museum of Natural History, New York City.... 1930
WILLIAMS, DR. J. T., Broadmoor Park, Colorado Springs, Col..... 1933
WILSON, MRS. BERYL M., Box 128, Davis, Calif..... 1930
WILSON, LEO K., 309 Monte Vista Ave., Oakland, Calif..... 1932
WILSON, ROBERT W., California Institute of Technology, Pasadena, Calif..... 1932
WINSON, J. W., Box 642, Sumas, Wash..... 1930
WINTHROP, FREDERIC, JR., 299 Berkeley St., Boston, Mass..... 1932
WINTON, PROF. W. M., Texas Christian University, Fort Worth, Tex..... 1922
WISLOCKI, DR. G. B., Dept. of Anatomy, Harvard Medical School, Boston, Mass.....Charter
WOLCOTT, OLIVER, Hamilton, Mass..... 1931
WOLFE, CAPT. L. R., 1819 West Pershing Road, Chicago, Ill..... 1923
WOOD, ALBERT E., 617 West 115th St., New York City..... 1928
WOOD, DR. CASEY A., 7 West Madison St., Chicago, Ill..... 1924
WOOD, MRS. FAE DONAT, Dept. of Zoology, University of California, Berkeley, Calif..... 1933
WOOD, PROF. HORACE ELMER, 2ND, Dana College, Newark, N. J..... 1924
WOODWARD, HARRY REUBEN, 205 Connor St., Hot Springs, S. Dak..... 1930
WRIGHT, DR. ALBERT H., Cornell University, Ithaca, N. Y.....Charter
WRIGHT, GEORGE M., 328 Hilgard Hall, University of California, Berkeley, Calif... 1928
WRIGHT, DR. SEWALL, Dept. of Zoology, University of Chicago, Chicago Ill.....Charter
WYLDE, HENRY ANSON, Los Angeles Museum, Exposition Park, Los Angeles, Calif..... 1931
WYMAN, DR. LELAND C., Dept. of Physiology, Boston University School of Medicine, Boston, Mass.....Charter
WYNNE-EDWARDS, VERO C., McGill University, Montreal, Can..... 1931
WYTHE, MISS MARGARET W., Museum of Vertebrate Zoology, Berkeley, Calif...Charter
*YAMASHINA, MARQUIS YOSHIMARO, 49, Nampeidai-machi, Shibuya-ku, Tokyo, Japan..... 1932
YERKES, DR. ROBERT M., 333 Cedar St., New Haven, Conn.....Charter

YOUNG, CHARLES H., National Museum of Canada, Ottawa, Ontario, Canada..... 1922
YOUNG, CHUNG-CHIEN, Ping Massu, 9, Peiping, China..... 1933
YOUNG, DR. W. A., 51 Carver St., Boston, Mass..... 1933
ZERNY, DR. H., Naturhistorische Museum, Burgring 7, Wien I, Austria..... 1933
ZIMMER, JOHN T., American Museum of Natural History, New York City....Charter
ZUCKERMAN, DR. S., 3 Museum Road, Oxford, England..... 1934

INDEX TO VOLUME 15

[New technical names in **bold-face** type]

A

agouti, 309.
allelomorphs, 302, 307.
Amebelodon, 179, 184.
  fricki, 182.
Amphimeryicidae, 209.
Anancus arvernensis, 183.
antelope, 43, 208, 289.
  pronghorn, 208.
Anthracotheriidae, 209.
Antilocapra, 209.
  americana americana, 43.
Antrozous **bunkeri, 227–228.**
  pacificus, 227.
  pallidus, 227.
Aonyx, 146, 149.
Apodemus agrarius coreae, 233–234.
  speciosus peninsulae, 233.
Aquila antiqua, 251.
  ferox, 251.
  lydekkeri, 251.
Archidiskodon, 179.
Artibeus jamaicensis, 316.
  jamaicensis palmarum, 316.
Artiodactyla, 207–209 (fig.).
Asiocricetus bampensis, 231.
  yamashinai, 231.
Aybeledon, 181.

B

badger, 13, 22, 141, 156–158, 244 (food), 289.
Bailey, V., The weasels of New York: Their natural history and economic status (Hamilton, reviewed), 74; Cave life in Kentucky, mainly in the Mammoth Cave Region (review, Howell), 163.
bat, 227–228, 316.
  big brown, 20, 156, 240–241.
  black-nosed, 20.
  interior long-legged, 20.
  little big-eared, 20.
  little brown, 156, 240–241.
  little bulldog, 89–99 (habits).
  little long-eared brown, 156.
  red, 156.
  silvery-haired, 156.
  spotted, 68.
  Yellowstone little brown, 19–20.
bear, black, 242.
  brown, 316–317.
  polar, 316.
beaver, 73, 322–323.
  Humboldt River, 29.
Bebb, W., Source of small birds eaten by the coyote, 320.
Black, J. D., Myotis grisescens and Myotis sodalis in Arkansas, 67.
Blarina, 292.
  brevicauda, 154.
Blickotherium, 181.
bobcat, 23.
Borell, A. E., and R. Ellis, Mammals of the Ruby Mountains region of Northeastern Nevada, 12; Mammals found near Jarbidge, Elko County, Nevada, 72.
Bos, 209.
Brachylagus, 251.
Brachypsalis, 145.
  modicus, 146.
  pachycephalus, 146.
  pristinus, 146.
Brevirostrinae, 183.
Brown, C. E., Captive pigmy elephants in America, 248.
Bunodonts, 208.
Burt, W. H., Subgeneric allocation of the white-footed mouse, Peromyscus slevini, from the Gulf of California, Mexico, 159.
Burt, W. H., and B. Campbell, Two new pocket gophers (Thomomys) from southern Arizona, 150.

Butler, A. W., Wild and domesticated elk in the early days of Franklin County, Indiana, 246.

C

Caenotheriidae, 209.
Caenotherium, 209.
Callospermophilus chrysodeirus trepidus, 16, 25–26, 72.
camels, 208.
Campbell, B., Notes on bats collected in Arizona during the summer of 1933, 241; (See also under Burt, W. H.).
Canimartes cumminsii, 139.
Canis, 243.
antarcticus, 45.
latrans, 45.
latrans estor, 319–320.
latrans lestes, 22–23, 72.
lupus coreanus, 230.
microtis, 47.
ochropus ochropus, 253.
pambasileus, 158.
Capreolus bedfordi, 229.
pygargus pygargus, 229.
Carpenter, C. R., A field study of the behavior and social relations of the howling monkeys, (review, Enders), 324.
Castor canadensis baileyi, 29.
Cavia porcellus, 309.
rufescens, 309.
Cerdocyon, 46.
thous, 49.
Cervus, 209.
canadensis canadensis, 246–248.
nannodes, 253.
Charronia flavigula, 139.
flavigula saba, 139.
chipmunk, 13.
eastern, 194–196 (life history).
Inyo, 27.
least, 15.
sagebrush, 26–27.
Choeronycteris mexicana, 241 (distrib.).
Chrysocyon, 45, 46, 243.
brachyurus, 49.
Citellus beringensis, 322.
elegans nevadensis, 13, 15, 16, 26, 72.
grammurus, 192.
osgoodi, 323 (melanism).
plesius ablusus, 322.
richardsoni, 322.
Clethrionomys, 292.
rufocanus regulus, 231.
coati, 317–318 (distrib.).
Cockerell, T. D. A., South American Canidae, 243.
comment and news, 87, 272.
Cordillerion edensis, 184.
Corynorhinus rafinesquii intermedius, 69 (fig.).
rafinesquii pallescens, 241, 242 (distrib.).
Cosomys primus, 246.
cougar, 71, 321.
coyote, 13, 22–23, 253, 286–290 (food), 319–320 (undershot jaw), 320–321 (food).
Cratogeomys fulvescens, 109.
merriami, 109.
oreocetes, 110.
Cricetidae, 288.
Cricetulus nestor, 232.
triton nestor, 231–233.
Crocidura coreae, 238.
dsinezumi, 236.
dsinezumi coreae, 236–237.
dsinezumi quelpartis, 236.
lasiura, 238.
lasiura lasiura, 237.
lasiura thomasi, 237.
lizenkani, 237.
longicauda, 237.
neglecta, 238.
thomasi, 238.
yamashinai, 237–238.
Cryptolestes, 154 (nomenclature), 240.
inca, 154.
Cryptotis parva, 154–155 (habits), 252.
Culbertson, A. E., Rediscovery of Dipodomys nitratoides exilis, 161.
Cuvieronius ayorae, 183.
platensis, 183.
postremus, 183.
superbus, 183.

D

Dasypterus intermedius, 316 (distrib.).
Davis, W. B., A study of the Idaho jumping mice of the genus Zapus, with remarks on a few specimens from British Columbia, 221.
de Beaufort, L. F., Dasypterus intermedius H. Allen in Cuba, 316.

deer, 13, 208, 288.
mule, 42, 72, 73.
southern black-tailed, 253.
Deinotheres, 177–184 (figs.).
Deinotherioidea, 181.
Deinotherium gigantissimum, 181.
Dice, L. R., An improved Peromyscus ration, 160; A black-eyed white Peromyscus, 246.
Dipodomys agilis, 210.
heermanni tularensis, 161.
ingens (food, figs.) 275–286.
merriami, 161.
nitratoides exilis, 161–162.
nitratoides nitratoides, 161.
ordii columbianus, 13, 29.
Dirias albiventer minor, 89–99 (habits).
Dixon, J. S., A cougar encountered in the open, 71; Mother wolf carries food twelve miles to her young, 158.
Dobzhansky, T., Are racial and specific characters non-mendelian?, 1.
Dog, 7 (fig.).
Falkland Island, 45.
Dunn, L. H., Notes on the little bulldog bat, Dirias albiventer minor (Osgood), in Panama, 89.
Durrant, S. D., A new wood rat from southeastern Utah, 65.
Dusicyon, 46, 243.
australis, 49.
culpaeus, 49.
griseus, 49.
gymnocercus, 49.
microtis, 49.
sechurae, 49.
thous, 49.
vetulus, 49.

E

Edge, E. R., Burrows and burrowing habits of the Douglas ground squirrel, 189.
elephant, pigmy, 248–250.
Elephantoidea, 181.
Elephas africanus, 248.
africanus pumilio, 249.
cyclotis, 248.
elk, 246–248.
dwarf, 253.
Ellis, R. (See under Borell, A. E.)
Enders, R. K., A field study of the behavior and social relations of the howling monkeys (Carpenter, reviewed), 324.
Enhydra lutris nereis, 253.
Enhydrictis galictoides, 141.
Enhydriodon, 145, 149.
Eptesicus fuscus, 156, 202 (marking), 242 (distrib.).
fuscus fuscus, 20, 240–241.
nilssonii, 239.
propinquus, 316.
Equus excelsus, 137.
Erethizon epixanthum bruneri, 70–71 (distrib.).
epixanthum epixanthum, 37–38, 73.
Erethizontidae, 288.
Eubelodon morrilli, 183.
Euderma maculatum, 68–70 (fig.).
Eutamias amoenus amoenus, 72.
amoenus monoensis, 72.
asiaticus orientalis, 230.
minimus pictus, 13, 16, 26–27.
quadrivittatus inyoensis, 16, 27.
Evans, C. A., Hibernating bats in Minnesota, 240.
Evotomys, 251.

F

Felis concolor hippolestes, 23.
ferret, black-footed, 70–71 (distrib.).
Fisher, Edna M., Early fauna of the Monterey region, California, 253.
Flerov, C. C., A new paleolithic reindeer from Siberia, 239.
flying squirrel, 64.
fox, 323.
red, 319.

G

Gazella, 209.
Gazin, C. L., On the priority of specific names for the upper Bridger Notharctus, 71; Upper Pliocene mustelids from the Snake River Basin of Idaho, 137.
Geist, O. W., Brown bear seen on St. Lawrence Island, 316.
Geomyidae, 288.
Geomys umbrinus, 106.
Gilmore, R. M., Notes on an apparent defense attitude in ground squirrels, 322.
Giraffa, 209.
giraffe, 208.

Glaister, John, Jr., A study of hairs of mammals, including human hair (review, Sperry), 74.
Glaucomys sabrinus griseifrons, 64.
sabrinus zaphaeus, 64.
Glossophaga soricina leachii, 316.
Goldman, E. A. (See under Nelson, E. W.)
gorilla, mountain, 51–61 (figs.).
Gorilla beringei, 52, 55, 58 (fig.).
gorilla, 52, 55 (fig.), 58 (fig.).
graueri, 53.
Gregory, P. W. (See under Storer, T. I.)
Gregory, W. K., On the significance of the supra-symphysial depression and groove in the shovel-tusked mastodonts, 4.
Griffin, D. R., Marking bats, 202.
Grinnell, J., and R. T. Orr, Systematic review of the Californicus group of the rodent genus Peromyscus, 210; The life histories and ecology of jack rabbits, in relation to grazing in Arizona (Vorhies and Taylor, reviewed), 259.
Grison, 141.
canaster, 138, 143.
ground squirrel, 13, 15, 322.
Douglas, 189–193 (habits, fig.).
golden-mantled, 25–26.
Nevada, 26.
guinea pig, 304, 309, 310, 314.

H

Hall, E. R., Certain osteological features of Euderma maculatum, 68–70; Sorex melanogenys Hall, a synonym of Sorex vagrans monticola Merriam, 155.
Hamilton, W. J., Jr., The weasels of New York: Their natural history and economic status (review, Bailey), 74; Habits of Cryptotis parva in New York, 154; Red squirrel killing young cottontail and young gray squirrel, 322.
Haplomylomys, 159, 160.
Henderson, Junius, and Craig, Elberta L., Economic mammalogy (review, Linsdale), 73.
Hesperomys californicus, 215.
parasiticus, 213.
Hesse, C. J., Another record of the fossil vole Mimomys primus (Wilson) from California, 246.
Heteromyidae, 288.
Hibbard, C. W., The occurrence of Erethizon epixanthum bruneri and Mustela nigripes in Kansas, 70; Antrozous bunkeri, a new bat from Kansas, 227.
Hill, J. E., External characters of newborn pocket gophers, 244.
hippotami, 208.
Hippopotamus, 209.
Hone, Elisabeth, Activities of the American Committee for International Wild Life Protection during 1933–34, 272.
horse, 7 (fig.).
Howell, A. H., Description of a new race of flying squirrel from Alaska, 64; The type locality of Pitymys parvulus, 72; Cave life in Kentucky, mainly in the Mammoth Cave Region (Bailey, reviewed), 163.

J

Johnson, C. E., Porcupine quills in a fox skull, 319.

K

kangaroo, 5 (fig.).
Kogia breviceps, 250–251.
Kolonocus sibiricus katsurai, 230.
sibiricus peninsulae, 230.
Kolonokus sibiricus, 243 (food).
Kuroda, N., Korean mammals preserved in the collection of Marquis Yamashina, 229.

L

lagomorphs, 304.
Lagurus, 15.
curtatus curtatus, 36.
curtatus intermedius, 13, 16, 35–36.
langurs, 124–137.
Lasionycteris noctivagans, 156.
Lasiurus borealis, 156.
Lawrence, Barbara, Wild coyote with an undershot jaw, 319.
Leopold, Aldo, White-tailed deer of the Adirondacks (Townsend, M. T., and Smith, M. W., reviewed), 163.
Leptonycteris nivalis, 241, 242 (distrib.).
Lepus, 251, 288.
alleni, 259.
bairdii, 152.
bairdii bairdii, 152.

Lepus bairdii oregonus, 152–154 (life history).
californicus, 259.
californicus deserticola, 16, 40–41, 73.
coreanus, 230.
townsendii townsendii, 16, 39–40, 73.
washingtonii, 152.
Lestodelphys, 154 (nomenclature).
halli, 154.
Lestoros inca, 240.
Linsdale, J. M., Economic mammalogy (Henderson and Craig, reviewed), 73.
list of members, 336.
Little, L., Seeds of the eucalyptus tree a new food for the Anthony gray squirrel, 158.
longirostrines, 182.
Loxodonta cyclotis, 250.
pumilio, 249.
Lutra canadensis, 145, 146, 148.
felina, 145.
ingens, 147–149.
lutra, 138, 145, 147.
pisciuaria, 137, 143, 144–147 (figs.).
platensis, 145.
Lutravus, 137, 145.
cookii, 142–143 (fig.).
halli, 139, 141, 142.
idahoensis, 137–142 (fig.).
Lutreola lutreola, 243 (food).
Lycalopex, 46.
vetulus, 45, 47, 49.
Lynx rufus pallescens, 23.
rufus pallidus, 16.

M

Mammonteus, 179.
marmot, 13.
Wet Mountain, 62–63.
yellow-footed, 23–25, 73.
Marmota flaviventris avara, 16, 23–25, 73.
flaviventris nosophora, 323 (melanism).
flaviventris notioros, 62–63.
flaviventris obscura, 62.
Martes americana, 140.
kinseyi, 140.
martes, 243 (food).
pennanti, 138, 140.
Martinogale, 140.
Mastodon americanus, 182.
andium, 184.
humboldtii, 183.
mirificus, 137, 183.
Mastodont, 177–184 (figs.).
shovel-tusked, 4.
Mastodontoidea, 181.
Matthew, W. D., and E. H. Colbert, A phylogenetic chart of the Artiodactyla, 207.
McAtee, W. L., Food habits of predatory mammals, 243.
Meles meles, 244 (food).
Mephitis mephitis major, 21.
occidentalis, 253.
Micraonys, 146, 149.
Micromys minutus hondonis, 234.
minutus ussuricus, 234.
Microtus, 251, 292.
innuitus innuitus, 323 (melanism).
montanus montanus, 15, 32–33, 73.
montebelli, 231.
mordax mordax, 16, 33–34, 73.
pelliceus, 231.
pennsylvanicus, 253.
pennsylvanicus nigrans, 253.
Miller, G. S., Jr., The langurs of the Presbytis femoralis group, 124.
Mimomys pliocaenicus, 246.
primus, 246.
Minerva, 251.
antiqua, 251.
mink, 21.
Miomastodon merriami, 182.
Mionictis, 140.
elegans, 140.
Mitchell, A. L., Eastern extension of the range of Peromyscus maniculatus bairdii, 71.
Moeritheres, 177–184 (figs.).
Moeritherioidea, 181.
Mogera wogura coreana, 238–239.
mole, 289.
Molossus sinaloae, 316.
monkeys, 124.
moose, 5 (fig.).
Morrillia barbouri, 183.
Moseley, E. L., Increase of badgers in northwestern Ohio, 156.
mountain lion, 23.

mouse, 185-189 (life history), 304, 310, 314.
big-eared, 31.
cantankerous meadow, 33–34.
canyon, 15, 30.
deer, 99–104 (development, fig.), 154.
desert harvest, 29–30.
European, 316.
field, 246 (albinism).
Great Basin pocket, 28–29
harvest, 15.
jumping, 13, 15, 290–300 (life history).
Mariposa white-footed, 217.
meadow, 155.
Monterey white-footed, 216.
Nevada jumping, 37.
parasitic white-footed, 213–215.
Peale meadow, 32–33.
prairie deer, 71.
San Benito white-footed, 216–217.
short-tailed grasshopper, 15, 29
Sonoran white-footed, 30–31.
southern parasitic, 218–220.
white-footed, 159–160, 210.
Muridae, 288.
Murie, A., A five legged rabbit, 162.
Murie, O. J., Melanism in an Alaskan vole, 323.
Mus bactrianus manchu, 235.
bactrianus yamashinai, 234–236.
californicus, 216.
kambei, 234.
molossimus yesonis, 235.
takagii, 234.
muskrat, Nevada, 36–37.
Mustela arizonensis, 20–21.
buwaldi, 140.
erminea, 243 (food).
eversmanni, 243 (food).
nigripes, 70–71 (distrib.).
nivalis, 243 (food).
putorius, 243 (food).
rixosa allegheniensis, 252.
sibirica manchurica, 229.
vison energumenos, 21.
Myotis daubentonii ussuriensis, 239.
evotis chrysonotus, 20.
grisescens, 67–68 (distrib.), 156 (distrib.).
keenii septentrionalis, 156, 202 (marking).
lucifugus, 156.
lucifugus carissima, 19–20.
lucifugus lucifugus, 202 (marking), 240–241.
sodalis, 67–68 (distrib.).
subulatus melanorhinus, 20.
velifer incautus, 68.
volans interior, 20.

N

Napaeozapus insignis insignis, 290–300 (life history).
Nelson, A. L., Notes on Wisconsin mammals, 252; Two mammal records for South Carolina, 253.
Nelson, E. W., 274 (obituary).
Nelson, E. W., and Goldman, E. A., Pocket gophers of the genus Thomomys of Mexican mainland and bordering territory, 105.
Neotoma albigula albigula, 65.
albigula brevicauda, 65–67 (fig.).
albigula laplataensis, 66.
cinerea cinerea, 16, 31–32.
cinerea occidentalis, 32.
fuscipes, 210, 215.
warreni, 66.
Nichols, D. G., and Nichols, J. T., Notes on Long Island, New York, bats, 156.
Noctilio leporinus mastivus, 92.
Notharctus crassus, 71.
robustior, 71 (nomenclature).
Notodelphys, 154.

O

Ocalientinus florescens, 183.
floridanus, 183.
republicanus, 183.
Ochotona, 251.
princeps nevadensis, 15, 16, 38–39.
Odocoileus columbianus scaphiotus, 253.
hemionus hemionus, 16, 42, 72, 73.
Oehser, P. H., Another new generic name for a South American marsupial, 240.
Okapia, 209.
Ondatra zibethica mergens, 13, 15, 36–37.
zibethica osoyoosensis, 37.
Onychomys leucogaster brevicaudus, 29.
Ornithorhynchus anatinus, 11.

Orolestes, 154, 240.
inca, 154.
Orr, R. T., Description of a new snowshoe rabbit from eastern Oregon, with notes on its life history, 152. (See also under Grinnell, J.)
Oryctomys bottae, 121.
Osborn, H. F., Evolution and geographic distribution of the Proboscidae: Moeritheres, Deinotheres and Mastodonts, 177.
Osgood, W. H., The genera and subgenera of South American canids, 45.
Otospermophilus douglasii, 189–193 (habits, fig.).
Otter, 137, 146.
finger, 149.
sea, 253.
Ovis canadensis, 43.

P

Palaeomastodon, 6, 182, 184 (fig.).
wintoni, 9 (fig.).
Pannonictis pliocaenica, 140.
Parelephas, 179.
Pearce, J., Albinism in the cinereous shrew, 67.
peccaries, 208.
Pentalophodon, 183.
Perodipus ingens (food), 275–286.
Perognathus californicus, 210.
parvus olivaceus, 13, 16, 28–29, 73.
Peromyscus, 160 (food), 292.
arcticus, 215.
boylii, 210.
boylii boylii, 211, 212.
californicus, 159, 210–220 (distrib. map).
californicus benitoensis, 216–217.
californicus californicus, 216, 217.
californicus insignis, 216, 217, 218–220.
californicus mariposae, 211, 217–218.
californicus parasiticus, 213–215, 216, 217.
crinitus crinitus, 16, 30.
insignis, 218.
maniculatus, 16, 210.
maniculatus artemisiae, 99–104 (development, fig.).
maniculatus bairdii, 71.
maniculatus gambelii, 212.
maniculatus sonoriensis, 15, 30–31, 73.
nebrascensis, 215.
polionotus polionotus, 246 (albinism).
slevini, 159–160
truei, 210, 212.
truei gilberti, 211.
truei truei, 16, 31.
Phiomia, 6, 182.
osborni, 179, 182, 184 (fig.).
pygmaeus, 182.
Phoca richardii geronimensis, 253.
pika, 15.
Nevada, 38–39.
Pipistrellus subflavus subflavus, 202 (marking).
Pitymys parvulus, 72 (type locality).
Platybelodon, 179.
barnumbrowni, 183.
danovi, 183.
grangeri, 4–12 (figs.).
Platygeomys planiceps, 109.
platypus, ducked-billed, 11.
Pliogale furlongi, 140.
Plionictis, 140.
pocket gopher, 105–124, 150–151, 244 (anatomy), 253, 300–312 (color variation).
Fisher, 27–28.
porcupine, 319.
yellow-haired, 37–38.
Nebraska yellow-haired, 70–71 (distrib.).
Potamotherium, 145.
Presbytes batuanus, 128.
sumatranus, 131.
Presbytis arwasca, 126, 127, 134, 135, 136
australis, 127, 128, 133, 135, 136.
batuana, 127, 128, 134, 135, 136.
cana, 127, 128, 133, 134, 135.
catemana, 127, 128, 133, 134, 135.
chrysomelas, 125, 127, 128–129, 132, 134, 135, 136.
cinerea, 129.
dilecta, 126, 127, 129, 132, 133.
femoralis, 127, 129–130, 132, 135.
keatii, 127, 130, 132, 133, 134, 135.

Presbytis natunae, 127, 130, 133, 134, 135.
neglecta keatii, 130.
nubigena, 129.
percura, 128, 130, 131, 133, 134, 135, 136.
rhionis, 127, 130, 133, 134, 135.
sumatrana, 127, 130–131, 134, 135, 136.
sumatranus, 131.
Pseudalopex, 46.
griseus, 46, 47.
sechurae, 46, 47.
Pteronura brasiliensis, 147.

R

rabbit, 13, 162, 288, 314.
Black Hills cottontail, 41.
black-tailed jack, 15, 40–41, 73.
brush, 253.
cottontail, 73, 322.
pigmy, 15, 41–42.
snowshoe, 152–154 (life history).
white-tailed jack, 39–40, 73.
Rangifer angustirostris, 240.
arcticus, 240.
caboti, 239.
constantini, 239–240.
rat, 304, 316.
Columbian kangaroo, 29.
giant kangaroo (food, figs.), 275–286.
kangaroo, 161.
Norway, 310.
Rattus norvegicus, 232.
norvegicus norvegicus, 234.
rattus alexandrinus, 234.
recent literature, 73, 163, 259, 324.
Reed, S. C., Mammalian lethal characters, 313.
reindeer, 239 (fig.).
Reithrodontomys megalotis megalotis, 29–30.
Rhynchotheres, 179.
Rhynchotherium, 181.
Ross, R. C., Age and fecundity of mule deer (Odocoileus hemionus hemionus), 72.

S

Saccophorus bottae, 121.
Salvesen, S., Air circulation in the beaver hut, 322.
Satherium, 143–144.
ingens, 147–149.
piscinaria, 144–147 (fig.).
Scheffer, T. H., Hints on live trapping, 197.
Schooley, J. P., A summer breeding season in the eastern chipmunk, Tamias striatus, 194.
Schultz, A. H., Some distinguishing characters of the mountain gorilla, 51.
Sciuridae, 288.
Sciuropterus aluco, 231.
russicus, 23.
russicus aluco, 231.
Sciurus carolinensis leucotis, 322.
griseus anthonyi, 158 (food).
hudsonicus loquax, 322.
seal, California harbor, 253.
sea lion, California, 253.
Selenodonts, 208.
Semnopithecus chrysomelas, 125, 128.
femoralis, 125, 129, 131.
natunae, 130.
neglectus, 129.
sumatranus, 128, 130.
Serbelodon burnhami, 183.
Serridentines, 183.
Serridentinus serridens, 183.
Shaw, W. T., The ability of the giant kangaroo rat as a harvester and storer of seeds, 275.
Sheep, mountain, 43.
Sheldon, Carolyn, Studies on the life histories of Zapus and Napaeozapus in Nova Scotia, 290.
Sherman, H. B., The occurrence of Myotis grisescens in Florida, 156.
shrew, 154–155 (habits), 289.
cinereous, 67 (albinism).
wandering, 15, 18–19.
water, 15, 19.
Simia maura, 129.
Sivaonyx, 145.
skunk, 289.
little spotted, 21.
prairie spotted, 318–319.
striped, 21, 253.
Snyder, Viola S., Harry Clay Trexler, 86 (obituary); Bessie A. White, 87 (obituary).

Sorex arcticus laricorum, 252.
cinereus cinereus, 67 (albinism).
leucogenys, 155.
longirostris longirostris, 254.
melanogenys, 155 (synonymy).
merriami, 155.
monticolus, 155.
palustris navigator, 16, 19, 72.
vagrans amoenus, 15, 16, 18–19, 72.
vagrans monticola, 155.
Sperry, C. C., A study of hairs of mammals including human hair (Glaister, reviewed), 74; Winter food habits of coyotes: A report of progress, 1933, 286.
Speothos, 46.
spermophile, thirteen-lined, 158.
Spilogale gracilis saxatilis, 13, 21.
interrupta, 318–319.
squirrel, Anthony gray, 158 (food).
gray, 322.
red, 322.
Stegomastodon, 183.
arizonae, 184.
texanus, 184.
Sthenictis, 142.
bellus, 140.
Storer, T. I., and Gregory, P. W., Color aberrations in the pocket gopher and their probable genetic explanation, 300.
Svihla, A., Development and growth of deermice (Peromyscus maniculatus artemisiae), 99.
Swanson, G., The little spotted skunk in northern Minnesota, 319.
Sylvilagus, 251, 288.
bachmani, 210.
bachmani bachmani, 253.
floridanus mearnsi, 322.
floridanus mearnsii, 162.
idahoensis, 13, 16, 41–42.
nuttallii grangeri, 16, 41, 73.
Synconolophus, 183.

T

Tadarida mexicana, 242 (distrib.).
Tamias striatus, 194–196 (life history).
tapir, 5 (fig.).
Tate, G. H. H., New generic names for two South American marsupials, 154.
Taxidea taxus taxus, 22, 72.
Tayassu, 209.
Taylor, W. P., Coati added to the list of United States mammals, 317.
Tayra, 139.
Telmatolestes crassus, 71.
Test, F. H., Records of bats from Honduras, 316.
Tetralophodon barbouri, 183.
fricki, 183.
longirostris, 183.
Thomomys, 300–312 (color variation).
atrovarius, 119.
baileyi, 124.
baileyi baileyi, 124.
baileyi mearnsi, 124.
baileyi nelsoni, 124.
bottae, 121, 309, 244–245 (anatomy).
bottae bottae, 253, 302, 308, 310.
bottae convergens, 107 (measurement, type spec.), 123–124.
bottae divergens, 107 (measurement, type spec.), 122–123.
bottae mewa, 303, 310.
bottae modicus, 122.
bottae navus, 301, 302, 308, 309, 310.
bottae pallescens, 302, 309.
bottae pascalis, 302, 311.
bottae phasma, 122, 123.
bottae puertae, 303, 311.
bottae sinaloae, 122, 123, 124.
bottae toltecus, 121.
bottae winthropi, 107 (measurement, type spec.), 122, 123.
burti, 115, 116, 117, 150.
burti burti, 151.
burti proximus, 151.
burti quercinus, 150–151.
fulvus, 150, 151, 309.
fulvus collinus, 117.
fulvus emotus, 116.
fulvus intermedius, 117.
fulvus modicus, 122.
fulvus phasma, 122.
fulvus toltecus, 121.
goldmani, 115.
intermedius, 115.
mearnsi, 124.

Thomomys nelsoni, 124.
niger, 302, 309, 312.
orizabae, 106, 309.
perditus, 115.
peregrinus, 108, 309.
perpallidus, 303, 311.
quadratus fisheri, 13, 27–28, 72.
quadratus uinta, 28.
rufescens, 309.
scapterus, 151.
sheldoni, 113.
sinaloae, 124.
simulus, 120.
simulus **parviceps,** 107 (measurement, type spec.), **121.**
simulus **simulus,** 107 (measurement, type spec.), **120–121.**
talpoides, 309.
talpoides clusius, 304.
toltecus, 121, 309.
townsendii, 309.
townsendii townsendii, 302, 309, 312.
umbrinus, 106, 309.
umbrinus **albigularis,** 106–108, 107 (measurement, type spec.), 110.
umbrinus **atrodorsalis,** 111–112.
umbrinus atrovarius, 119, 120, 121.
umbrinus burti, 117, 118, 120.
umbrinus **caliginosus,** 107 (measurement, type spec.), **116,** 118.
umbrinus **chihuahuae,** 107 (measurement, type spec.), **114,** 118.
umbrinus **chiricahuae,** 107 (measurement, type spec.), **117.**
umbrinus **crassidens,** 107 (measurement, type spec.), **113.**
umbrinus durangae, 115.
umbrinus **durangi,** 107 (measurement, type spec.), **114.**
umbrinus emotus, 116–117.
umbrinus **enixus,** 107 (measurement, type spec.), **112–113.**
umbrinus **evexus,** 107 (measurement, type spec.), **115.**
umbrinus **eximius,** 107 (measurement, type spec.), **118–119.**
umbrinus **extimus,** 107 (measurement, type spec.), **119–120.**
umbrinus goldmani, 115.
umbrinus intermedius, 116, 117, 118, 120.
umbrinus **madrensis,** 107 (measurement, type spec.), **115–116,** 120.
umbrinus **martinensis,** 107 (measurement, type spec.), **108–109.**
umbrinus **musculus,** 107 (measurement, type spec.), **119.**
umbrinus orizabae, 106, 109.
umbrinus perditus, 115.
umbrinus peregrinus, 108.
umbrinus **potosinus,** 107 (measurement, type spec.), **111,** 112.
umbrinus sheldoni, 112, 113, 114, 118.
umbrinus **sonoriensis,** 107 (measurement, type spec.), **118,** 120.
umbrinus **supernus,** 107 (measurement, type spec.), **110.**
umbrinus **tolucae,** 107 (measurement,. type spec.), **109,** 110.
umbrinus umbrinus, 106, 109.
umbrinus **vulcanius,** 107 (measurement, type spec.), **109–110.**
umbrinus **zacatecae,** 107 (measurement, type spec.), **112.**
Tomkins, I. R., A pigmy sperm whale from the Savannah River entrance, 250.
Torynobelodon, 9.

Townsend, M. T., and Smith, M. W., White-tailed deer of the Adirondacks (review, Leopold), 163.
Tragulus, 209.
Trexler, Harry Clay, 86 (obituary).
Trilophodon, 182.
angustidens gaillardi, 182.
fricki, 182.
lulli, 182.
Tscherskia albipes, 231.
Turicius, 182.

U

Urocyon, 45.
cinereoargenteus, 49.

V

vole, Alaskan, 323 (melanism).
sagebrush, 15, 35–36.
Vorhies, C. T., and Taylor, W. P., The life histories and ecology of jack rabbits, in relation to grazing in Arizona, (review, Grinnell and Orr), 259.
Vulpes vulpes, 243 (food).

W

Warren, E. R., A new subspecies of marmot from Colorado, 62.
Watt, Lucy J., Frequency distribution of litter size in mice, 185.
weasel, mountain, 20–21.
Welch, Dorothy, Bears in Estes Park, Colorado, 242.
Wetmore, A., The types of the fossil mammals described as Aquila antiqua and Aquila ferox, 251.
whale, pigmy sperm, 250–251.
White, Bessie A., 87 (obituary).
wildcat, 13.
Williams, C. S., A simple method for sectioning mammalian hairs for identification purposes, 251.
wolf, Falkland Island, 45.
Mount McKinley timber, 158.
wood rat, 13, 65, 210.
bushy-tailed, 31–32.
Wright, G. M., Cougar surprised at well-stocked larder, 321.

Z

Zalophus californianus, 253.
Zapus hudsonius hudsonius, 290–300 (life history).
princeps, 221–227 (distrib. map).
princeps cinereus, 222, 225.
princeps curtatus, 224.
princeps idahoensis, 221–224.
princeps kootenayensis, 222, 225–226.
princeps major, 224.
princeps nevadensis, 16, 37, 73, 224.
princeps oregonus, 221, 222, 225, 226
princeps palatinus, 223, 224.
princeps princeps, 222, 224–225, 226.
princeps saltator, 224, 226.
Zygolophodon borsoni, 182.

MEMBERSHIP

Anyone interested in any phase of mammalogy is eligible for membership in the American Society of Mammalogists, and if elected will receive the Society's official publication, the Journal of Mammalogy, quarterly. Name and address, with remittance of $3.00 for annual dues, may be sent to the Corresponding Secretary, or to any officer of the Society. Membership is dated from the nearest January, although formal election will not take place until the annual meeting of the Society following the receipt of application.

Back volumes of the
Journal of Mammalogy
are still available as follows:

Vol. 1. (1919–1920, 5 numbers)	$8.25
Vol. 2. (1921)	7.50
Vol. 3. (1922)	10.00
Vol. 4. (1923)	4.00
Vol. 5. (1924)	7.50
Vol. 6. (1925)	4.00
Vol. 7. (1926)	4.00
Vol. 8. (1927)	4.00
Vol. 9. (1928)	4.00
Vol. 10. (1929)	4.00
Vol. 11. (1930)	4.00
Vol. 12. (1931)	4.00
Vol. 13. (1932)	4.00
Vol. 14. (1933)	4.00

A discount of 20 per cent is allowed to members in good standing.
There is a small surplus of several odd numbers at $1.00 each.

Monographs of the American Society of Mammalogists:

1. **Anatomy of the Wood Rat,** by A. Brazier Howell.....$5.00

225 pages, 34 line drawings, 8 color plates and three half-tones.

Members are allowed a discount of 8 per cent.

2. **The Beaver: Its work and ways,** by Edward R. Warren.....$1.00

177 pages, 78 halftones and diagrams.

3. **Animal Life of the Carlsbad Cavern,** by Vernon Bailey....$1.00

192 pages, 66 halftones, 2 maps, 1 colored.

Robert T. Hatt, *Corresponding Secretary*
The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y.

JOURNAL OF MAMMALOGY

CONTENTS

PAGE

The Ability of the Giant Kangaroo Rat as a Harvester and Storer of Seeds ..... *William T. Shaw* 275

Winter Food Habits of Coyotes: A Report of Progress, 1933 ..... *Charles C. Sperry* 286

Studies on the Life Histories of Zapus and Napaeozapus in Nova Scotia ..... *Carolyn Sheldon* 290

Color Aberrations in the Pocket Gopher and Their Probable Genetic Explanation ..... *Tracy Irwin Storer* and *Paul Wallace Gregory* 300

Mammalian Lethal Characters ..... *Sheldon C. Reed* 313

General Notes 316

Dasypterus intermedius H. Allen in Cuba, *L. F. de Beaufort*; Records of Bats from Honduras, *Frederick H. Test*; Brown Bear on St. Lawrence Island, *Otto William Geist*; Coati Added to the List of United States Mammals, *Walter P. Taylor*; The Little Spotted Skunk in Northern Minnesota, *Gustav Swanson*; Porcupine Quills in a Fox Skull, *Charles E. Johnson*; Wild Coyote with an Undershot Jaw, *Barbara Lawrence*; Source of Small Birds Eaten by the Coyote, *William Bebb*; Cougar Surprised at Well-Stocked Larder, *George M. Wright*; Red Squirrel Killing Young Cottontail and Young Gray Squirrel, *W. J. Hamilton, Jr.*; Notes on an Apparent Defense Attitude in Ground Squirrels, *Raymond M. Gilmore*; Air Circulation in the Beaver Hut, *Sigvald Salvesen*; Melanism in an Alaskan Vole, *Olaus J. Murie*.

Recent Literature 324

List of Members 336

Index 355